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VOL. CXLVIII.—No. 3851] LONDON: FRIDAY EVENING, NOVEMBER 1, 1929 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 2d.

PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Tuesday, 10th November, 1929, for ACCELERATED LOW-PRESSURE HOT WATER HEATING at the "Acorn" Telephone Exchange, Acton, W.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 3588

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/1579.—ENGINEER (ARCHITECTURAL) REQUIRED by the GOVERNMENT of HONG KONG for the Public Works Department for three years' service, and possible permanency. Salary £460 a year, rising by annual increments of £20 to £500 a year, and thereafter, in the event of the appointment being made permanent, by further increments to a maximum of £1000 a year, payable in dollars under the Compensation Scheme at present in force at a favourable rate of exchange. Free first-class passages provided. Candidates, unmarried, 23 to 30 years of age, must be Associates of the R.I.B.A. and be conversant with all the usual routine of an Architectural Office, including the preparation of sketch plans and working drawings, specifications, quantities, measuring, &c., in connection with new buildings, additions and alterations. Some knowledge of steel and reinforced concrete design and construction is also necessary.

M/1807.—CIVIL ENGINEER REQUIRED by the GOVERNMENT of CEYLON for appointment as Irrigation Engineer for three years' service and prospect of permanency. Salary £500, rising to £900 a year by annual increments of £40 (£600 a year on attaining 30 years of age). Free quarters and free passages provided. Candidates, unmarried, 26 to 31 years of age, must have passed examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from parts A and B of that examination, and have had at least three years' practical experience on Waterworks, Drainage or Harbour and Dock Works.

Apply at once by letter, stating age and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 6328

Research Department, WOOLWICH.

REQUIRED, TWO DRAUGHTSMEN, age between 25 and 35 years. Rate of pay, commencing at 55s. per week (basic) plus Civil Service bonus, making present total salary 59s. 6d. per week.

Annual leave 18 days per annum.

Candidates should have had a good general and technical education, preferably matriculated, served apprenticeship in engineering works and have had at least two years on detailing of small machines and instruments.

Preference given to ex-Service men suitably qualified.

Applications to be made by letter, accompanied by copies of not more than three testimonials, to the CHIEF SUPERINTENDENT, Research Department, Woolwich, S.E. 18. 3626

The Government of the Punjab invite APPLICATIONS for TWO APPOINTMENTS of ASSISTANT EXECUTIVE ENGINEER in the Punjab Public Works Department, Hydro-electric Branch. Candidates should be between the ages of 25 and 37 years. They must possess an Engineering Degree or Diploma recognised by the Institution of Civil Engineers. The work in hand includes (A) reservoir and reinforced concrete construction, (B) excavation and lining of a hydro-electric pipe tunnel and sinking of a surge shaft, construction of a pipe track and reinforced concrete work. Preference will be given to applicants experienced in such work, particularly in hilly country. Agreement for two years and six months. Pay in accordance with an age scale, e.g., age 25 years, Rs. 475 a month plus overseas pay Rs. 150 a month; age 30, Rs. 625 plus overseas pay of £25; age 34, Rs. 825 plus overseas pay £30; age 37, Rs. 975 plus overseas pay £30. (Approximate sterling equivalents at current rate of exchange £562, £862, £1102, £1237 per annum.) Provident Fund. Free first-class passage to India on appointment and return passage on satisfactory termination of agreement. (Overseas pay and return passage admissible only to candidates of non-Asiatic domicile.)

Forms of application and further particulars may be obtained upon request by postcard to the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for the receipt of applications 23rd November, 1929. 3622

PATENTS AND DESIGNS ACTS, 1907 TO 1928.

Notice is Hereby Given That ALFRED ERNEST WHITE, of the firm of Messrs. White, Langner, Stevens, Parry and Rollinson, formerly of Jessel Chambers, 88-90, Chancery-lane, London, W.C. 2, now of 5-9, Quality-court, Chancery-lane, London, W.C. 2, SEEKS LEAVE to AMEND the SPECIFICATION of LETTERS PATENT No. 311,636, granted for an invention communicated to him by Consolidated Expanded Metal Companies and entitled "Improvements in or relating to Metal Laths."

Particulars of the proposed Amendment were set forth in the "Illustrated Official Journal (Patents)" of the 23rd October, 1929.

Any person, or persons, may give Notice of Opposition to the Amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton-buildings, London, W.C. 2, within one calendar month from the date of the said Journal.

W. S. JARRATT,
Comptroller-General.
3591

For the Installation of a WATER-SOFTENING PLANT and ALTERATIONS to the WATER SUPPLY at the King's Lynn Poor Law Institution.

Particulars from W. A. Warner, 23, Market-street, King's Lynn.

Deposit, £1 2s., to be sent to the CLERK TO THE GUARDIANS, King-street, King's Lynn.

Closing date, November 6th. P6339

The Engineer

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PUBLIC NOTICES

University of Bristol.

FACULTY OF ENGINEERING.

APPLICATIONS are INVITED for the appointment of ASSISTANT LECTURER and DEMONSTRATOR in CIVIL ENGINEERING. Salary £300 per annum.

Full particulars may be obtained from the Secretary, The University, Bristol, to whom applications should be forwarded on, or before, November 6th. 3558

Acton Borough Council.
TO TURBINE PUMP AND HEAVY OIL ENGINE MANUFACTURERS.

The Town Council invite TENDERS for the SUPPLY and ERECTION of PUMPING PLANT for lifting crude sewage at the Sewerage Works, Warple Way, Acton, London, W. 3.

The installation will consist of Five Heavy Oil Engines coupled through reduction gearing to Low-lift Turbine Type Sewage Pumps of four varying sizes, capable of lifting from 2500 to 16,000 gallons per minute, the aggregate capacity being about 37,500 gallons per minute.

Specification, forms of Tender, with schedules of particulars to be submitted, may be obtained on application to the undersigned, on payment of a deposit of £2 2s., which will be refunded upon receipt of a bona fide Tender and the return of all loaned documents.

Tenders are to be delivered to the Town Clerk, Municipal Offices, Acton, W. 3, not later than 4 p.m. on the 3rd day of December, 1929.

The Council does not bind itself to accept the lowest or any Tender.

W. G. CROSS, Assoc. M. Inst. C.E.,
Borough Engineer.
Municipal Offices, Acton, W. 3,
October, 1929. 3534

PUBLIC NOTICES

Borough of Twickenham.
SEWAGE DISPOSAL WORKS.

The Corporation are prepared to receive TENDERS for :—

CONTRACT No. 1.—ALTERATIONS to BUILDINGS, TANKS, &c., at the Sewage Disposal Works, Mereway-road, Twickenham, and the CONSTRUCTION of certain LENGTHS of 24in. diameter and 30in. diameter CONCRETE TUBE SEWERS, in enlarging the Effluent Outfall from the Sewage Disposal Works to the River Thames, with TIDAL OUTLET and other appurtenant WORKS.

CONTRACT No. 2.—PUMPING MACHINERY, comprising VERTICAL CRUDE OIL COLD-STARTING ENGINES, GEARING, CENTRIFUGAL PUMPS, AUXILIARY PLANT, and ACCESSORIES.

Specification, drawings and bill of quantities can be inspected at the Office of the Consulting Engineer, Mr. William Fairley, M. Inst. C.E., Parliament Mansions, Westminster, S.W. 1, or at the Office of the Borough Engineer and Surveyor, Mr. Gilbert R. King, Municipal Offices, Twickenham. Copies of the quantities and the machinery specification can be obtained at either of the above offices on deposit of a crossed cheque for £2 2s., made payable to the Corporation, which deposit will be returned on receipt of a bona fide Tender.

Sealed Tenders, on the forms supplied, are to be sent to the undersigned not later than Noon on Tuesday, the 12th day of November, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

EDWIN G. STRAY,
Town Clerk.
Municipal Offices, Twickenham,
19th October, 1929. 3524

Central London School DISTRICT.
TENDERS FOR ELECTRO-MOTOR, &c.

The Managers of the Central London School District invite TENDERS for the SUPPLY and INSTALLATION of an ELECTRO-MOTOR, with REDUCTION GEARING, STARTER, &c.

Firms desiring to Tender are requested to apply for specification and form of Tender to the undersigned.

Sealed Tenders are to be delivered at the offices of the Central London District School, Greenford-avenue, Hanwell, W. 7, addressed to the undersigned, not later than the 22nd November.

The Managers do not bind themselves to accept the lowest or any Tender.

By Order,
GEORGE P. MORRELL,
Clerk to the Managers.
3587

PUBLIC NOTICES

Bengal-Nagpur Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for :—

23,850 YARDS CLOTH CANVAS FOR TARPAULINS.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after Monday, 28th October, 1929.

A fee of 10s. will be charged for each copy of the specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Thursday, 7th November, 1929.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
R. C. VOLKERS,
3589 Secretary.

Bengal-Nagpur Railway Com- PANY, LIMITED.

The Directors are prepared to receive TENDERS for :—

WATERPROOF CANVAS.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after Wednesday, 30th October, 1929.

A fee of 10s. will be charged for each copy of the specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Friday, 8th November, 1929.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
R. C. VOLKERS,
3612 Secretary.

County Borough of South- AMPTON.
TO CONTRACTORS AND OTHERS.

The Corporation invite TENDERS for the LAYING and JOINTING of about 1600 YARDS of 12in. C.I. SOCKET and SPIGOT WATER MAIN from Totton to Eling Village, near Southampton.

Plans may be seen and specification, bill of quantities and form of Tender obtained at the Waterworks Engineer's Office, 21, Shirley-road, Southampton, upon production of the Borough Treasurer's receipt for a deposit of Two Guineas. Deposits will be returned after the Council have dealt with the Tenders to those who have submitted bona fide Tenders.

Sealed Tenders, endorsed "Tender for 12in. Water Main, Totton to Eling," on the prescribed form, together with priced quantities and schedule, must be delivered at the Town Clerk's Office, Municipal Offices, Southampton, on or before 10 a.m. on the 18th November, 1929.

The Council do not bind themselves to accept the lowest or any Tender.

R. RONALD H. MEGGESON,
Town Clerk.
30th October, 1929. 3625

State Electricity Commission OF VICTORIA, AUSTRALIA.
22-32, WILLIAM-STREET, MELBOURNE, AUSTRALIA.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY and ERECTION of ONE ELECTRICALLY OPERATED MOBILE COAL TRIMMING MACHINE having Caterpillar Treads and a Boom of sufficient length to provide an effective working reach of 90ft., in accordance with Specification No. 30/1.

Copies of Tender form, specification, &c., will be available upon application to the Agent-General for Victoria, Victoria House, The Strand, London, England.

Charge £1 1s. for set of two copies complete, returnable under certain conditions as specified in the general conditions of tendering. Extra copies 10s. 6d. each, not returnable.

Tenders, on prescribed form, properly endorsed and addressed and accompanied by a preliminary deposit of £25, must be delivered to the undersigned in Melbourne not later than 3rd February, 1930.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
3623 Secretary.

Wandsworth Union.

The Guardians of the above-named Union are prepared to receive TENDERS for PROVIDING and FIXING a NEW HIGH-PRESSURE STEAM DISINFECTOR with VACUUM and HOT AIR APPARATUS at the St. John's Hospital, St. John's-hill, Wandsworth, S.W. 18. Firms wishing to Tender will be required to send in alternative schemes, drawings, and estimates for :—

(A) The "Oval" type, capacity of chamber approximately 60 cubic feet.

(B) The "Rectangular" type, capacity of chamber approximately 110 cubic feet.

The site can be inspected by appointment with the Clerk of Works at the above address.

Tenders, &c., to be sent in endorsed Tender form envelopes to my office not later than 9 a.m. on 20th November, 1929.

By Order,
J. F. HARLOW,
Clerk.
Union Offices :
St. John's-hill, Wandsworth, S.W. 18,
30th October, 1929. 3620

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PUBLIC NOTICE

South Indian Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STEEL WORK for BRIDGES, and
2. POINTS and CROSSINGS, &c.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Steel Work for Bridges," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 22nd November, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of each specification.

Copies of drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1.
30th October, 1929. 3635

Borough of Swindon.

ASSISTANT TO MECHANICAL ENGINEER.

The Corporation of Swindon invite APPLICATIONS for the APPOINTMENT of an ASSISTANT to the MECHANICAL ENGINEER in charge of the Waterworks, at a commencing salary of £208 per annum.

The person appointed will be, in due course, required to reside in a house which is to be erected near the Ogbourne Works, for which a small rent will be charged.

Applicants must have a thorough knowledge of the construction and maintenance of Multi-stage Turbine Pumps and Cold-starting Oil Engines, whilst a good knowledge of Reciprocating Pumps will be deemed an added qualification.

Application, stating age (which is not to exceed 40) and experience, with copies of not more than three recent testimonials, and endorsed "Waterworks Assistant," to be delivered to the undersigned not later than first post on Monday, the 18th November, 1929.

The applicant selected for appointment will be required to pass a medical examination and (if appointed) to contribute to the fund established under the Local Government and Other Officers' Superannuation Act, 1922, when the post has been designated.

Canvassing, either directly or indirectly, will disqualify.

W. H. BENTLEY,
Town Clerk.

Town Hall, Swindon.
28th October, 1929. 3610

County Borough of Newport, Mon.

ASSISTANT WATERWORKS ENGINEER REQUIRED IMMEDIATELY for 18 months, with possible extension. Must have considerable experience in the design of Earth Dams and Ancillary Works and the preparation of working drawings and taking out of quantities for same, &c. Salary £400 per annum.

Applications, endorsed "Assistant Waterworks Engineer," stating age, details of experience in chronological order, and accompanied by copies of not more than three testimonials, to be sent to the undersigned not later than 14th November, 1929.

W. E. LLOYD, M. Inst. C.E.,
Borough and Water Engineer.

Town Hall, Newport, Mon.,
29th October, 1929. 3615

Public Authority in North of England REQUIRES ENGINEERS and ASSISTANT ENGINEERS in connection with extensive New Road Construction for three or four years. Salaries according to experience and qualifications.

Resident Engineers	£500-£600
Assistant Engineers	£300-£400
Engineering Assistants and Draughtsmen	£208-£260
Junior Assistants	£156-£208

Address in confidence, with full particulars, 3601, The Engineer Office. 3601 A

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, an ASSISTANT ENGINEER on a large Housing Scheme near London; experienced in Setting-out of Houses, Levelling and General Progress Work.—Reply, stating age, experience, and salary required, to Box 711, c/o Brown's, 39, Tothill-street, S.W. 1. 3608 A

CHIEF SALES MANAGER REQUIRED for Heavy Engineering Firm; must have good knowledge of home and export trade and agency work and capable of organising sales office on modern lines.—Reply, which will be treated in strictest confidence, should state age, experience, and salary required, and should be addressed to 3632, The Engineer Office. 3632 A

ENGINEER REQUIRED to Take Charge of Erection of large Installation of Conveying Machinery abroad. Only first-class men with good training and experience need apply.—Box No. 538, G.P.O., Manchester. 3602 A

ENGINEER SALESMAN, with Technical Training and Midland connection, REQUIRED by important progressive Manufacturers of Non-ferrous Alloys and Die Castings. Adequate salary and expenses.—Write, full details of age, experience, &c., 3600, The Engineer Office. 3600 A

ENGINEERING ASSISTANT WANTED on Design and Lay-out of Main Sewers for Housing Estate in neighbourhood of London. Salary about £6 a week.—Write, stating age and experience, to "ENGINEER," Box 141, c.o. R. Anderson and Co., 14, King William-street, Strand, W.C. 2. 3616 A

JUNIOR ELECTRICAL ENGINEER, with Degree or equivalent, familiar with Light Current and Valve Amplifier Work, REQUIRED for Experimental Work. Works experience an advantage. Applications should be tabulated and give full particulars of work done and certificates obtained, with dates, age, and salary required, to Box E515, c/o C. Mitchell and Co., 1, Snow-hill, E.C. 1. 3542 A

MECHANICAL ENGINEERS REQUIRE TECHNICAL ENGINEERING CORRESPONDENT, with practical Shop Experience and ability to prepare Lay-outs.—Write, stating age, experience and salary required, 3596, The Engineer Office. 3596 A

MECHANICAL ENGINEER, with All-round Technical training, REQUIRED for a Quantity Production Factory in Essex; good mathematician and detailed knowledge of modern Machine Tools essential. Age 25 to 35. Only really competent men with initiative need apply. State age, experience and salary required.—Address, 3614, The Engineer Office. 3614 A

HEAVY ELECTRICAL PLANT MANUFACTURERS REQUIRE experienced ENGINEER in connection with Export Work. Applicants should be capable of Preparing and Discussing Schemes, Interviewing Clients and generally supervising this side of the manufacturers' business. Overseas experience desirable, but not essential. Knowledge of German and Spanish an advantage.—Address, stating age, qualifications, experience and salary required, 3599, The Engineer Office. 3599 A

SMART ESTIMATOR WANTED, Accustomed to Carbonising Plants and Coke Ovens.—Write, with particulars of experience, salary required, &c., to Z.F. 434, c/o Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 3624 A

PITMAN'S LATEST BOOKS.

THE MANUFACTURE OF CHILLED IRON ROLLS.

By ARCHIBALD ALLISON. This book contains a systematic record of practical work performed in the maintenance foundry of a works entirely occupied with rolling steel. It is a book of great importance to all engineers. *The Foundry Trades Journal* describes it as "a book which will arouse great interest . . . a metallurgical landmark." Demy 8vo, 120 pp. **8s. 6d. net.**

PITMAN'S TECHNICAL DICTIONARY IN SEVEN LANGUAGES.

Edited by ERNEST SLATER, M.I.E.E., &c. A large four-volumed collection of practical engineering and industrial words and terms, translated in English, French, German, Spanish, Italian, Portuguese and Russian. Indispensable to engineering firms. Price (four vols. complete) **£8 8s. net.**

Of a Bookseller, or

SIR ISAAC PITMAN & SONS, LTD.,
PARKER STREET, KINGSWAY, LONDON, W.C. 2.

SITUATIONS OPEN (continued)

WANTED by Well-known Firm of Mechanical Engineers, a highly qualified HEAD DRAUGHTSMAN. Must have initiative and good powers of organisation and staff control.—Address in strict confidence, stating age, qualifications, and experience and salary required, 3631, The Engineer Office. 3631 A

WANTED, DRAUGHTSMAN for Manufacturing concern in London; preference given to one having had experience as Works Maintenance Draughtsman, with knowledge of Constructional Steelwork, Building, and General Engineering.—Apply in writing, giving particulars of age, training, experience and salary required, to the CHIEF ENGINEER, Canning Town Glass Works, Ltd., Stephenson-street, London, E. 16. 3592 A

WANTED, SENIOR DRAUGHTSMAN, with Machine Tool experience, for Midlands. State full experience, age, and salary required. Also JUNIOR or IMPROVER, accustomed to Tools and Jigs.—Address, 3559, The Engineer Office. 3559 A

ASSISTANT CHIEF DRAUGHTSMAN, Manchester area; wide experience of Medium and Heavy Engineering, especially Pumps and other Hydraulic Plant. State age, experience and salary.—Address, 3605, The Engineer Office. 3605 A

CAPABLE CONSTRUCTIONAL STEELWORK DESIGNING DRAUGHTSMAN REQUIRED for London office, with knowledge of London Building Acts. State age, experience, and salary required.—Address, 3607, The Engineer Office. 3607 A

CIVIL ENGINEERING DRAUGHTSMAN WANTED for Preparation of Plans of Roads and Sewers for Housing Estate in neighbourhood of London. Salary about £4 10s. a week.—Write, stating age and experience, to "DRAUGHTSMAN," Box 142, c.o. R. Anderson and Co., 14, King William-street, Strand, W.C. 2. 3617 A

DRAUGHTSMAN.—A Capable MAN REQUIRED, with extensive experience in the Design and Detailing Mechanical Apparatus and Chemical Plant. The position has good possibilities for a man showing energy and accuracy in detail. Age about 28.—Address, stating age, whether married, full particulars of previous experience, and salary required, 3641, The Engineer Office. 3641 A

DRAUGHTSMAN, Engineers', for Quarry and Contractors' Machinery. State age, wage, and experience.—Address, 3634, The Engineer Office. 3634 A

DRAUGHTSMAN (HEATING), also ASSISTANT, REQUIRED IMMEDIATELY.—Write, stating age, experience, and salary required, 3643, The Engineer Office. 3643 A

DRAUGHTSMAN REQUIRED by Large Engineering Firm in Lancashire, with wide experience of Instrument and Meter Work.—Address, with particulars of age, training, experience, and salary required, 3529, The Engineer Office. 3529 A

DRAUGHTSMAN REQUIRED, with Experience in Commercial Vehicle Chassis Design. Near London.—Address, 3630, The Engineer Office. 3630 A

DRAUGHTSMAN REQUIRED, with Good Knowledge of Mechanical Design, preferably Woodworking Machinery or Machine Tools. Good prospects suitable applicant.—Apply by letter, with full details, stating age and salary required, to HARRIS LEBUS, Finsbury Works, Tottenham, London, N. 17. P6356 A

DRAUGHTSMEN.—The BRITISH THOMSON-HOUSTON CO., Ltd., Rugby, has VACANCIES for SENIOR DRAUGHTSMEN, with good Steam Turbine or Motor and Electrical Apparatus experience.—Applications, stating age, experience and salary required, with references, to MANAGER, Drawing-Offices, B.T.H. Co., Ltd., Rugby. 3603 A

DRAUGHTSMAN WANTED for General Engineering, Birmingham district. Full particulars of experience, qualifications, salary required, &c.—Address, 3598, The Engineer Office. 3598 A

ENGINEERING DRAUGHTSMAN REQUIRED, with some experience of Reinforced Concrete or Structural Steel Design. State age, experience, and salary required.—Address, 3636, The Engineer Office. 3636 A

FIRST-CLASS DRAUGHTSMAN WANTED AT ONCE, with thorough training and experience in Designing Electric Overhead and Jib Cranes. Age, experience, and salary.—Address, 3609, The Engineer Office. 3609 A

HEATING ENGINEERS (Bristol) REQUIRE SENIOR DRAUGHTSMAN with experience Heating and Hot Water Supplies; commencing salary £250 per annum to suitable man. State age, experience.—Address, P6349, The Engineer Office. P6349 A

HENRY BERRY and CO., Ltd., Croydon Works, Leeds, have VACANCY for fully qualified LEADING DRAUGHTSMAN; experience in Hydraulic Machinery essential; also sound knowledge of General Engineering. State age, experience and salary required. 3604 A

JIG and TOOL DRAUGHTSMEN WANTED IMMEDIATELY for Machine Tool Work. State age, full experience and salary required.—Address, 3597, The Engineer Office. 3597 A

PETTERS LIMITED, of Yeovil, REQUIRE a First-class DRAUGHTSMAN, experienced in Preparation of Installation Drawings of Oil Engines and other machines.—Apply, giving particulars of experience and salary required, to CHIEF ENGINEER, Petters, Ltd., Yeovil. 3615 A

SITUATIONS OPEN (continued)

REQUIRED, a Capable MECHANICAL DRAUGHTSMAN for a South Wales works; one with previous Rolling Mill Experience preferred.—Address, stating age, experience and salary required, 3618, The Engineer Office. 3618 A

ENGINEER WORKING FOREMAN WANTED for General Works, provincial district, about 20 hands. One used to Traction and Portable Engines, Repairs, Pumps and Agricultural Work; knowledge of drawing essential. Age 30 to 35. Two recent references (copies only, not returnable). State salary, when disengaged. Good house free.—Address, 3573, The Engineer Office. 3573 A

FOUNDRY FOREMAN, Used to Machine Moulding Air-cooled Cylinders and Small Repetition Work. Only thoroughly experienced men need apply.—Address, stating experience and wages required, 3595, The Engineer Office. 3595 A

SITUATIONS WANTED

A PROGRESSIVE FOUNDRY MANAGER (Disengaged) REQUIRES suitable POST. Sound practical and technical training (loam, dry sand and green sand); successful career; highest references; 13 years' control and development medium and large foundries and patternshops for repetition and jobbing castings up to 30 tons in ferrous and non-ferrous alloys (expert metallurgical control of mixtures) for gas, oil and steam engines, pumps, automobile, electrical, machine tool, marine, machinery, &c. &c.—Address, P6352, The Engineer Office. P6352 B

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ENGINEER, Mechanical and Electrical, with Wide works and commercial experience, OPEN to ACCEPT any POSITION of TRUST. First-class organiser.—Address, P6357, The Engineer Office. P6357 B

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

A Year's Boiler Explosions.

THE report on the working of the Boiler Explosions Acts, 1882 and 1890, during the year ended December 31st, 1928, shows that in the course of the twelve months the Board of Trade held inquiries into sixty-two boiler explosions. Of these sixty-two explosions twenty-four resulted in the loss of lives or in personal injury, seven persons in all being killed and twenty-eight injured. The seven deaths were caused by five explosions, of which three were on land and two at sea. All the inquiries conducted by the Board were of the preliminary kind except in one instance, in which a formal investigation was ordered. This exception related to the explosion of a steam wagon boiler in which it was found that the front end plate stays had fractured some time before the explosion occurred. The owners' acting manager and chief engineer were held to blame, and were ordered to pay £100 and £25 respectively towards the cost of the investigation. It is satisfactory to note that the steady rise in the annual number of explosions, which has been a marked feature of the Board's report since and including the year 1921, has been interrupted, the number being 62 last year, as compared with 79 in 1927. The number of deaths and cases of injury also show a welcome reduction, the figures being in both categories only about one-third of what they were in 1927. Of the 62 explosions, exactly half were of steam generators, of which 11 were in use on land and 20 in use at sea. The remaining 31 explosions were of steam pipes in bakers' ovens, economisers, pans, drying cylinders, &c. It is noteworthy that of the 62 generators, vessels, &c., which exploded, 36 were inspected and insured by various bodies or companies, 18 were not inspected or insured by anyone, seven were insured only, and one was inspected only.

Large Oil Engine Order for Australia.

THREE of the largest mining companies in Australia operating in the Broken Hill district recently decided to effect economies by centralising their power plant requirements in one station. This new power station will supply all the electric current and compressed air required by the three companies, namely, The North Broken Hill, Ltd., The Broken Hill South, Ltd., and the Zinc Corporation, Ltd. It has been decided to install compression-ignition oil engines for the prime movers, and orders have been placed with Mirrlees, Bickerton and Day, Ltd., of Stockport, for four 1230 B.H.P. "Mirrlees-Diesel" engines, the value being approximately £50,000. Each engine will drive a Belliss and Morcom air compressor. The electricity generating sets have been ordered from Messrs. Sulzers, and will consist of six 3000 B.H.P. oil engines, each driving alternators manufactured by the British Thomson-Houston Company, of Rugby. The Australian General Electric Company is the main contractor for the supply of the compressing sets, switchgear and electrical accessories. The cost of the whole scheme will be about half a million pounds sterling, and, when completed, the station will be one of the largest oil engine power stations in the world. Mr. F. J. Mars, of Melbourne, has been responsible for the development of the scheme.

Wireless Telephony on Ships.

OVER six years ago the White Star Line fitted a Marconi wireless telephone installation on the "Olympic," but at that date there was no great demand by the travelling public for the communication facilities that were made available, and the service was not extended. But since 1923 great strides have been made in wireless telephony between ships and shore, and the public has also acquired the habit of making use of wireless telephony. As a result, the White Star Line has made arrangements with Standard Telephones and Cables, Ltd., to install modern short-wave radio telephone equipment on board the "Olympic," and the Marconi Marine Company will co-operate in experiments with this equipment on board, the Marconi Company being responsible for the wireless telegraph service on all White Star liners. It is anticipated that as a result of experiments made with this installation, passengers on the "Olympic" will be able to telephone from mid-ocean to their homes or places of business, and carry on an ordinary telephone conversation. In the event of the experiments proving successful, the White Star Line intends to place similar facilities at the disposal of the passengers on their other vessels.

Subway and Manhole Explosions.

IN his annual report to the Home Secretary and the Corporation of London, Dr. F. J. Waldo, his Majesty's coroner for the City of London and the Borough of Southwark, urges that, in view of recent subway fires and explosions in electrical manhole boxes, it is desirable to extend the principles of the London Fire Inquests Act of 1888 to the whole kingdom. Under that Act 192 inquiries were held in 1928, and in two cases inquests were found necessary. It may be explained that this Act gives Dr. Waldo power to inquire into fires occurring in his area, whether they are attended with fatal consequences or not. The two fire inquests in 1928 dealt with outbreaks in subways on the Thames Embankment. The main conclusion reached was that in no circumstances should any cable, capable of producing a spark, be laid in a subway carrying a supply of coal gas. Dr. Waldo calls attention to the serious effect which might well be produced by a large-scale explosion in the Embankment subway, and points out that such an explosion might lead to disastrous flooding by causing a breach in the Embankment wall. He argues that there is an urgent need for a Government inquiry into the question of subways generally throughout London. That inquiry, he suggests, might be extended to deal with explosions in electrical manhole boxes, of which there were six cases within his area in 1928.

Charing Cross Bridge.

ON Tuesday of this week the London County Council passed the first vote on account of the Charing Cross Bridge scheme. It was for the sum of £5000, and was in respect of remuneration likely to fall to be payable to Mr. Frederick Palmer during the current financial year. It was stated that the total fees to be paid to Mr. Palmer for his services as engineer to the scheme were estimated at between £180,000 and £200,000. It was explained, however, that these fees would cover a period of probably seven years, and that considerably more than 50 per cent. of them would be actual out-of-pocket expenses of the engineer or overhead charges. The estimated cost of the scheme is £12,500,000, so that had the Council paid the usual 5 per cent. which the Ministry of Transport had advised it was the proper fee, it would have incurred an expenditure much in excess of that which the special arrangement with Mr. Palmer will involve. Some debate arose as to the payment of the salary to the resident engineer. It was suggested that this charge should be met by Mr. Palmer, and not, as had been arranged, by the Council. In addition, it was contended that by making the resident engineer responsible to the Council the arrangement would institute an undesirable division of responsibility. To this criticism, it was replied that the payment of the resident engineer's salary by the Council was in accordance with universal practice. The responsibility for the construction of the bridge would, it was added, be shared by Mr. Palmer and the Council's Chief Engineer. It was explained that Mr. Basil Mott's health had recently not been good, and that the Council could not as a consequence be recommended to appoint him to undertake the work. It had been arranged, however, to obtain his advice when desired in a consultative capacity, and that Mr. Palmer would pay to Mr. Mott any fees that might accrue to him for such services.

L.N.E.R. Dock Improvements.

IT is announced by the London and North-Eastern Railway Company that approval has now been given for the immediate putting in hand of a number of schemes for dock improvements. These schemes include additional sidings for coal traffic and a re-arrangement of working facilities at Hartlepool, with four new water columns and a 20,000-gallon water tank for locomotive use. The Hartlepool scheme is expected to expedite considerably the forwarding of coals from the collieries to the port. At Hull the coal-tipping appliances are to be adapted for dealing with 20-ton wagons, and the older docks are to be brought into line with the King George Dock, which is already equipped for dealing with large wagons. New electric cranes are also to be installed at the Grimsby Royal Dock, and on the east side of the same dock new upper stories are to be added to the transit sheds. The hydraulic cranes at this port are to be entirely modernised, so that the time for the loading of outgoing vessels can be shortened. The mineral empties yard at Doncaster is to be remodelled, and an artificial "hump" added to speed up the sorting of the traffic. The present dead-end sidings are to be converted into double-ended sidings, and three new reception tracks and new engine line are to be added. Between Doncaster and Spalding new independent lines are to be built to give relief to both the passenger and the fast goods traffic, and additional running loops, each capable of holding ninety wagon trains, are to be constructed at eight selected points.

The Battersea Power Station.

ACCORDING to an official announcement, the London Power Company, Ltd., has placed an order with Sir William Arrol and Co., Ltd., for the supply and erection of the structural steel work for the first section of its new super-power station at Battersea. It will be recalled that this section, which was sanctioned in 1927 by Parliament, represents only one-third of the whole scheme. About six months ago, when the matter was raised in the House of Lords, Government assurance was given that the remaining part of the scheme would not be sanctioned unless it was agreed by all authorities that there would be no danger to health and that vegetation and buildings would not be harmed by the fumes from the station. There has been considerable opposition to the scheme, and, as recorded in our issue of October 18th, the Westminster City Council and the Kensington and Chelsea Borough Councils intend to promote a private Bill during the present parliamentary session to revoke the official consent given to erect the station. On the other hand, according to a recent statement of the London Power Company, its engineers and chemists have now evolved a satisfactory and commercial method of dealing with the problem of the sulphur fumes. Work on the site near Battersea Bridge was begun in March last, and the foundations are now being prepared.

New Wearmouth Bridge at Sunderland.

YESTERDAY—Thursday, October 31st—the new bridge over the river Wear at Sunderland was formally declared open by the Duke of York. The bridge has never actually been closed during the whole two and a-half years of its construction, for a temporary bridge was used to convey the traffic while the old bridge was being dismantled and the new structure built. The new bridge, which has been constructed to the designs of Messrs. Mott, Hay and Anderson, of Westminster, by Sir William Arrol and Co., Ltd., of Glasgow, replaces a cast iron bridge designed in 1796 by Rowland Burdon, which in 1858 was partially reconstructed by Robert Stephenson, who converted the six cast iron ribs into three box girders by the addition of wrought iron plates. The new bridge is a single span of the three-pinned arch type, with two mild steel ribs of parabolic form set 54ft. 6in. apart, and having a total span of 376ft., the ends being supported on masonry abutments. The ribs have a rise of 105ft., and the roadway is carried at a height of 93ft. 3in. above the high water level of the river, giving a clear height for shipping of 85ft. 6in. The roadway, which carries two tramway tracks, is 48ft. wide, and there are footpaths 15ft. 9in. wide on each side of the roadway, making a total of 79ft. 6in. between the parapets. The cost of the new bridge will be close upon a quarter of a million pounds, towards which the Ministry of Transport is contributing a certain portion.

Another Air Liner Disaster.

ON the afternoon of last Saturday, October 26th, the Imperial Airways Machine "City of Rome," an all-metal three-engined flying boat of the Short "Calcutta" type was lost with all on board—a crew of three and four passengers—off the West Coast of Italy, near Spezia. The machine was flying homewards on the Cairo-Genoa section of the weekly Karachi-Croydon air mail service. The cause of the disaster is not known. The machine encountered a gale, and after sending out an S.O.S. call, descended on to the sea. It seems to have alighted safely. For an hour a small Italian steamer, the "Famiglia," made efforts to tow it to safety, but the tow ropes broke and eventually the steamer lost touch with the machine. Naval assistance was sought by the steamer at Spezia, but further search indicated that the machine had broken up and that all the occupants had perished. The Italian authorities, and particularly the captain and crew of the "Famiglia," exerted themselves to the utmost to save those on board the machine. In the state of the sea prevailing at the time it was impossible to transfer the passengers and crew of the machine to the steamer, and when the tow rope parted the "Famiglia" was left in pitch darkness, except when flashes of lightning illuminated her immediate surroundings, to search for the lost machine. The air liner, it would appear, was on the surface of the water for some three hours before the "Famiglia" reached her. That she withstood the buffeting of the gale for any such period is a wonderful testimonial to her structure. This disaster is the third this year which has overtaken Imperial Airways machines. On June 17th the "City of Ottawa" was lost in the English Channel, involving the deaths of seven people. On September 6th the "City of Jerusalem" caught fire on landing at Jask in Persia, with the loss of three lives.

Future of the Schneider Trophy Race.

ON Wednesday of this week the Government issued an announcement to the effect that no Royal Air Force Team will again be entered for the Schneider Trophy Seaplane Contest. The reasons given for this decision are that Government participation in the competition has caused it to assume a character which is not in accordance with the intentions of the late Monsieur Jacques Schneider, its originator, and that as sufficient data have now been collected for the practical development of high-speed aircraft, the large expenditure of public money involved by Government participation in the contest is no longer justifiable. It is added that convincing proof has now been obtained as to what the British aircraft industry can do, and the wide public interest displayed in the contest should make it possible for British pilots and machines to compete in what is intended to be an international sporting event on the basis of a private enterprise. The announcement has come as a great surprise. That the Government's decision will be greatly regretted and severely criticised is certain, particularly in view of the fact that if this country wins any one of the next three contests the Trophy will become finally its property.

Kempton Park Pumping Station of the Metropolitan Water Board.

No. II. (*conclusion*).*

THE NEW PUMPING ENGINES.

In our first article we described the primary filters which have just been constructed at the Kempton Park Pumping Station of the Metropolitan Water Board, and the arrangements which have been made in order to deal with the increased volume of filtered water which the provision of those filters will enable that station to supply. In the present article we propose to describe the additional pumping engines which it has been necessary to install.

It will be remembered that the original pumping plant was capable of lifting, by means of three units, a total of 24 million gallons of water per day against a head of 170ft. The new plant is designed to pump: (*a*) 24 million gallons per day against a head of 400ft., or (*b*) 32 million gallons per day against a head of 300ft., or (*c*) 38 million gallons per day against a head of 200ft. There are two units and they are, we understand, more powerful than any other steam pumping engines of this type which are in operation in Europe at the present time. Certainly they are a magnificent pair of engines, which reflect the greatest credit on their designers and builders alike. They were constructed by Worthington-Simpson, Ltd., of Newark-on-Trent, to designs prepared, under the direction of Mr. Stilgoe, in the drawing-office of the Board. In general design these two engines closely resemble the reciprocating engine at the Board's Walton works, though they are, of course, considerably bigger. There is one point, however, in which they differ from that engine. It is that, in them, cast iron "A" frames have been reverted to, the steel pillars which form so prominent a feature of the front of the Walton engine not having been perpetuated. We understand that the decision to revert to "A" frames was made before the Walton engines were at work, and it was thought preferable, having in view the greater size, to have "A" frames. In actual work, however, the steel columns have been found perfectly rigid.

Before going on to describe the new engines in detail, we propose to discuss, briefly, the new arrangements which it has been necessary to make in connection with them. In the first place, an entirely new engine and boiler-house had to be provided. A view of the station, taken from the air, is given in Fig. 10. In it will be seen the two Kempton Park reservoirs in the background, with the slow sand filters in the middle distance and the new primary filter house and the sludge beds in the foreground. To the right are to be seen the old and new pumping stations. The new pumping station has been built closely adjoining the original pumping station on land already in the possession of the Board. The new and old station buildings are shown in Fig. 9. As will be observed from the plan, Fig. 1 *ante*, both the Staines Aqueduct and the Littleton Conduit run parallel with one another, and closely adjacent to the new building. A railway siding also runs close alongside it. This siding gives direct communication to Midland coalfields *viâ* the Southern Railway near Sunbury Station, and also *viâ* the Board's 2ft. gauge railway to its pumping station at Hampton, which is actually on the bank of the river Thames. The advantage of the latter connection is considerable, for, by means of it, coal, which has been conveyed from the North direct to Hampton by water, can be taken on to the Kempton Park Station by the Board's own locomotives, the railway journey being comparatively short, only some 2 miles. From whichever source the coal is derived the wagons are taken along the siding to a tippler opposite the end of the new boiler-house. The tippler, which was made by Babcock and Wilcox, Ltd., is of the ordinary circular-rotary type, in which the wagon is automatically held clamped in the cradle during the operation of tippling. It is electrically operated and can accommodate 12-ton wagons. The coal is discharged into an underground hopper, which has a capacity of 35 tons. The outlet at the bottom of the hopper is in communication with a gravity bucket conveyor, which has a capacity of 20 tons per hour. By it, the coal is taken along a subway into the boiler-house and then upwards to above the level of the tops of the coal bunkers, and then horizontally over the latter, arrangements being made by which it can be discharged into any part of the bunkers, of which there are five. The conveyor is electrically operated, is automatic in its action, and is of a standard type, which does not call for particular description. It, too, was made by Babcock and Wilcox, Ltd.

The new station building, which closely resembles in style the pumping station at the Queen Mary Reservoir at Littleton, is constructed of brickwork with Portland stone dressings. It is connected with the original engine-house by means of a corridor, in which are an induced draught fan chamber, sanitary offices, mess and store rooms, &c. The chimney shaft, which is a replica of the shaft of the original station, is of brickwork, octagonal in plan, 135ft. high and 6ft. 6in. internal diameter. An electrically-driven induced draught fan is fitted in the main flue at the base of this chimney. It was specified to be of sufficient capacity to burn 3½ tons of rough slack coal per hour at the rate of 25 lb. per square foot of grate area. Both boiler and engine-house have their internal walls lined to dado level with glazed bricks.

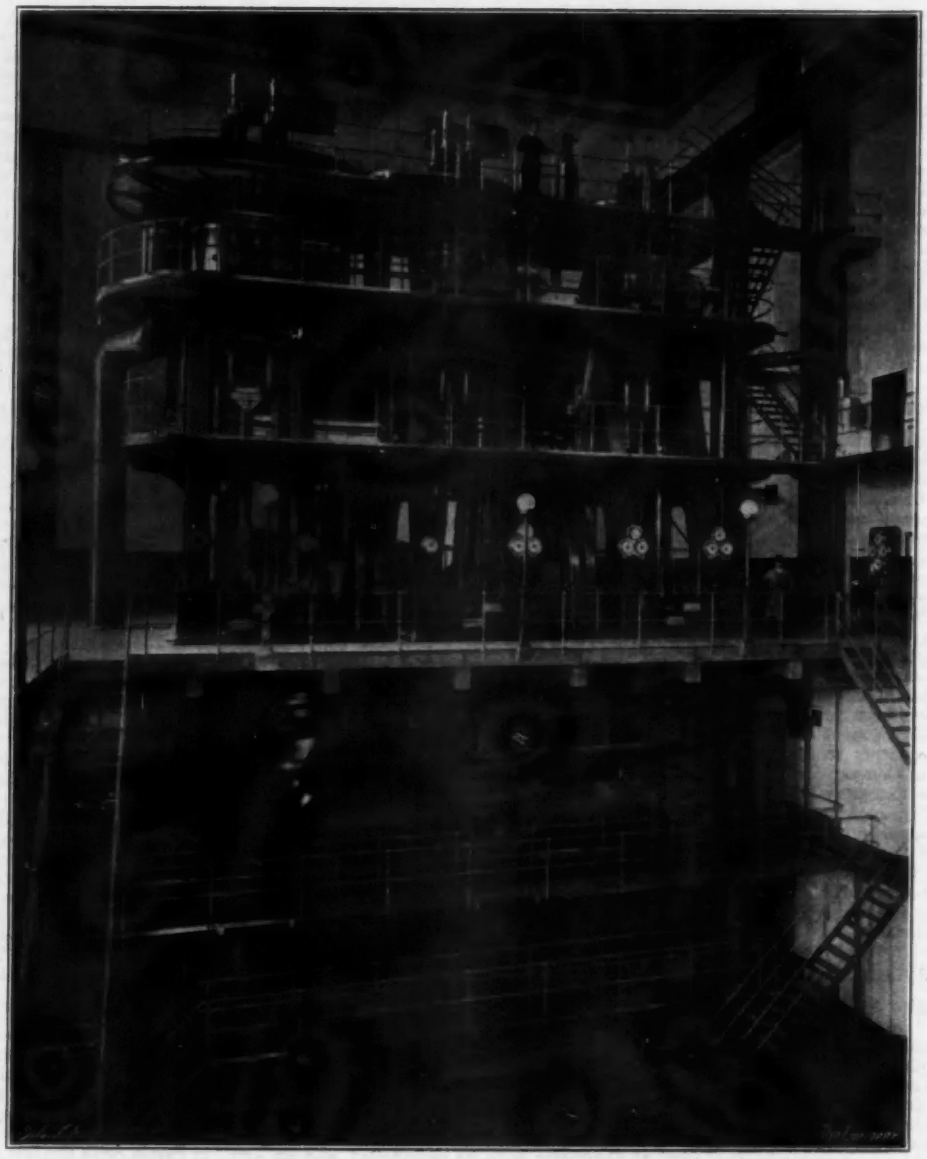


FIG. 8—ONE OF THE 1000 H.P. PUMPING UNITS

The new boiler installation comprises six water-tube boilers made by Babcock and Wilcox, Ltd., who were the contractors for the whole boiler equipment, including the coal and ash-handling plants. In the boiler-house there is room to install four additional boilers as and when it becomes necessary to do so. The six boilers are arranged in three batteries of two. They are of the double-drum type and are constructed for a working pressure of 200 lb. per square inch and 150 deg. of superheat. Each has a total heating surface of 2690 square feet, and each has a chain-grate stoker of 72 square feet area. The coal is supplied to the grates in the ordinary way by steel chutes from the overhead bunkers, being weighed just before it enters the chutes by automatic weighing machines made by Avery, Ltd. A Green's economiser is arranged at the rear of each boiler.

The ashes and clinker pass over the back ends of the grates and are received into hoppers at the bottoms of which are chutes, the lower ends of which are led beneath the surface of water contained in a cast iron trough. In this way, not only are the ashes quenched, but an air seal is provided so that the chimney draught is not interfered with. Each boiler has its own ash trough, and in each trough there is an inclined steel shaft having at its lower extremity a cast iron wheel, which dips down nearly to the bottom of the tank and which is furnished at its periphery with vanes so shaped that, as the wheel is revolved, the ashes are lifted and discharged on to a conveyor belt which runs, horizontally, from end to end of a basement formed below the boilers. The inclined shafts and their wheels are revolved by means of a horizontal shaft, to which they are connected through gearing and clutches. This horizontal shaft is revolved in stages by an electrically operated ratchet and pawl arrangement, the clutches being provided so that any lifting wheel which is not required at any time may be disconnected. The water troughs are furnished with overflows connected to a drain channel, and are kept continously supplied with water from the pressure main through a cistern fixed on the wall of the basement. The water draining from the troughs is pumped to waste by a small centrifugal pump which is operated by a water turbine, which, in turn, is driven by the water from the pumping main as it passes to the tank supplying water to the trough. At the end of the basement the belt, which is electrically operated and which runs at the rate of 50ft. per minute, is taken upwards at an angle through an underground passage to the boot of a bucket elevator, where the ashes are discharged and lifted by the elevator into a steel storage bunker having a capacity of 50 tons, arranged outside the boiler-house and near to the point at which the coal arrives. From this bunker the ashes may be discharged into carts, and we gather that there is a sufficient local demand for them to keep the plant clear.

For driving the stokers there are both an electric motor and a small steam engine so as to provide an alternative drive, and there are two feed pumps, of the vertical type, each designed to deliver 3500 gallons of water per hour against the full boiler pressures. Each pump delivers through a feed water heater. There is also an evaporator with a capacity of 800 gallons per hour to furnish the make-up water. The gauge equipment is of a most complete character, instruments for making all the necessary measurements—draught, CO_2, CO, H, temperature, &c.—being provided. The dial instruments have large faces and they are all fixed in places where they may be readily read by the attendants. As in others of the Board's pumping stations, there is also a small room between the boiler and engine-rooms where are arranged the instruments of the recording type, &c.

A word or two must be added regarding the lagging, both of the boilers and of the piping, which has been excellently carried out and forms quite a feature of the installation. The actual insulating material, which is plastic magnesia, is nowhere visible. It is all encased in planished sheet steel. In the exposed portions of the boilers, cast iron kerbs are fitted round the mountings and manholes to assist in finishing off the lagging neatly. The ends of the drums, too, are completely covered with polished ornamental cast iron circular panels. The whole of the steam, feed,

* No. I. appeared October 25th.

evaporator and jacket return piping, the trapped drains as far as the steam traps, as well as the exhaust piping from the feed pumps and stoker engine, as far as the feed water heaters, and the feed tank, inclusive of the valve and separator bodies, are lagged with the insulating material of such thicknesses that the diameter over the non-conductor is ½in. more than the diameter of the respective pipe flanges, and the whole is covered with planished sheet steel carried right over the flanges, the portions over the flanges being in short sections for easy removal, all the parts being secured with polished steel bands. The general effect is distinctly pleasing, and it gives to the boiler-house an appearance of neatness which is particularly noticeable.

With so much description of the coal and ash-handling arrangements and of the steam generating plant we can now return to the main pumping engines. It is almost impossible to refer to these huge pumping units without employing superlatives. When dealing with the engine at the Walton Station, which has a height of 52ft. from the pump foundation to the highest point of the steam cylinders, we used the term "majestic." What stronger word can we find to apply to the twin engines at Kempton Park, which are, each of them, 10ft. higher than the Walton engine? It will be best, we think, not to search for one, but to let figures speak for themselves.

To begin with, the height of each unit from the base of the pumps to the tops of the valve bonnets is 62ft. It has, unfortunately, been found impossible to take a photograph of these engines and their pumps as they are erected on the site, which gives an adequate idea of their magnitude. The half-tone engraving given in Fig. 8 does not really convey to the eye a correct impression of their immensity, though the figures of the men are of some assistance in forming some conception of it. The two views on page 468, which are reproduced from photographs taken in the makers' works, show both engine and pumps, separately, very fairly well, but they do not present a correct picture of the complete unit as it exists in the pumping station. Fig. 11, however, shows the tops of the cylinders excellently. Each unit comprises a vertical triple-expansion engine operating three single-acting plunger pumps. The diameter of the high-pressure cylinder is 29in., of the intermediate cylinder 54in., and of the low-pressure cylinder 86in. The crank shaft, which weighs 30 tons, is 19½in. in diameter in the journals and 26½in. at the fly-wheels. There are two 17ft. diameter fly-wheels, each of which weighs 32 tons. The total weight of shaft and fly-wheels is, therefore, 94 tons. The stroke of all three cylinders is the same, *i.e.*, 5ft. 6in.

Each engine is carried on six pump valve chambers, a valve box being arranged on each side of the three ram cases. Each cylinder with its pump is therefore self-contained. The three pumps of each engine are single-acting, and, as is now the standard practice of the Board for engines which may be called upon to pump at varying heads, they have compound rams, each comprising two plungers, one concentric with the other. We illustrated and described a compound ram of this type when referring to the engine at Walton in our issue of August 13th, 1926. There will, therefore, be no necessity to describe it in detail in the present instance, since, in all essentials, the Kempton Park rams are identical with those at Walton. It will be sufficient to say that with compound plungers it is possible to pump either a comparatively large quantity of water at a comparatively low head when the two plungers are bolted together so as to form a large-diameter ram, or a smaller quantity at a comparatively high head when the inner and smaller plungers only are used, the outer plungers being bolted to the pump casings. The dimensions are such that, in either case, the horse-power exerted by the engine is approximately the same. In the present case, with both plungers bolted together, the effective diameter of the ram is 30½in., whereas the diameter of the inner plunger is 25½in. With the larger plungers in operation each pumping unit will lift water at the rate of just over 19,000,000 gallons per day—disregarding slip—at a speed of 25·4 revolutions per minute, and that is the highest rate at which the engines are intended to operate.

As the weight of the engine is, as has been explained, carried by the six valve chambers of the pumps, the absence of masonry piers permits of any of the valve chambers being withdrawn, should any of them fail, without the adjacent valve boxes having to be removed. There are two longitudinal girders—one on each side of the engine—with their ends embedded in the structure of the engine-house building. On these girders rest cast iron transverse girders which are attached to the underside of the engine bed-plate; but, normally, they do not take any appreciable weight. Their object is merely to support the weight of the engine should the removal of a valve box become necessary. To facilitate this operation, folding wedges are provided between the supporting brackets on the valve chamber tops and the engine bed-plate girders.

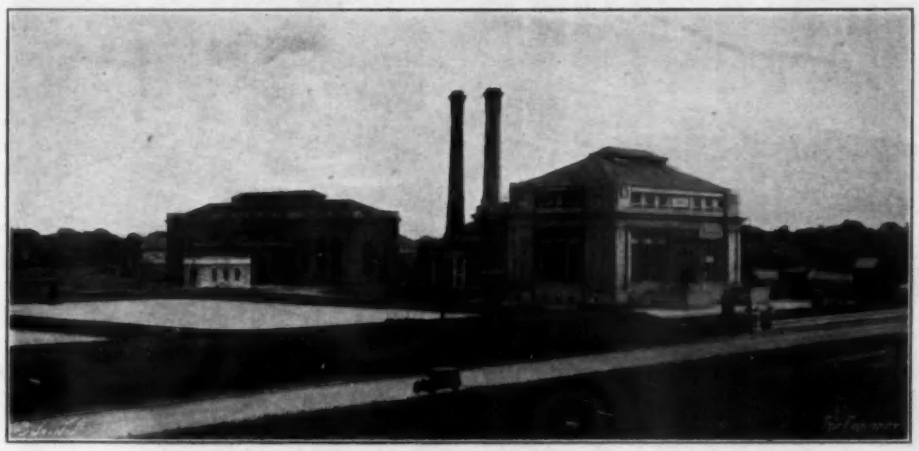


FIG. 9—THE OLD AND NEW PUMP HOUSE BUILDINGS

To attempt to give anything approaching a complete description of these fine engines in an article of this character would be out of the question; we shall therefore confine ourselves to referring to a few leading points. The valves for both the intermediate-pressure and the low-pressure cylinders are of the single-beat type, and there are two inlet and two exhaust valves to each cylinder. The high-pressure cylinder was not, however, large enough to accommodate single-beat valves, so that double-beat valves—one of each—were applied to the inlet and the exhaust. The beats were, however, kept as close together as possible, so as to minimise the effects of changes of temperature and variation of expansion. All the valves work in cages which are readily renewable, and which are jointed to their respective cylinder covers and made steam-tight by a single metal-to-metal joint. The cages are held on to the joint by set-screws passing through a mild steel ring. Each valve is connected to its spindle by a flexible connection in such a way that the valve may be free to move in its cage in the direction that is required, while the valve spindle does the same in its labyrinth. Any misalignment in any direction of the valve spindle relative to the valve does not, therefore, affect the valve, which can always seat itself truly on its beat. The only direction in which the valves and spindles are constrained is in the direction of their required axial movement when the former are opening and closing. All the valve spindles work through long labyrinths secured in the valve chest covers, and stuffing-boxes have been entirely dispensed with.

The valve gear, which has been specially designed, deserves extended description. To give a really satisfactory description of it is, however, well-nigh impossible without the aid of drawings, and, unfortunately, the makers of the engines are unwilling that any drawings of the gear should be published. The drive is direct from the crank shaft through bevel gear to a shaft which runs up nearly vertically to another set of bevel gear driving a horizontal lay shaft. The positions of these shafts and gears can be seen in Figs. 11 and 12. The horizontal lay shaft, which runs closely alongside all three cylinders, has mounted on it cams, the motion of which is transmitted to the steam and exhaust valves through a system of rollers, levers and rods. The cams for operating the steam valves are of the variable type, so that the distance between the leading and trailing edges of the cam is capable of adjustment, and so that, consequently, the range of cut-off can be varied between the minimum and maximum essential for the duty which the engine has to perform. A single cam operates both top and bottom steam valves of each cylinder, but as it is not possible with it alone to get the same cut-off at the top and bottom ends of the cylinder, a compensating cam device has been added, and by it the cut-off on the upward and downward strokes of the engine may be equalised.

The cam rollers are mounted on horizontal levers and the rollers are kept in contact with the cams by springs arranged in boxes above and below the bottom levers. The motion of these levers is transmitted by rods which act directly on the system of levers which opens and closes the steam and exhaust valves. These levers are of the variable fulcrum type, and the design is such that the leverage is at a maximum at the instant the valve is being opened; that is to say, when the valve mechanism has to operate at maximum load. As soon as the valve is opened it is practically in equilibrium, so that the load imposed on the gear by the steam pressure is removed. The mechanism has then only to overcome the weight of the parts and the pressure of the springs which maintain the parts in contact. During the remainder of the opening of the valve the leverage is gradually reduced, and it is at a minimum when the valve is wide open.

When the valve begins to close it moves quickly, but its velocity is gradually reduced until, at the instant of closing, the movement is made quite slow so that quiet operation of the gear may be obtained, hammering avoided and wear on the beats may be minimised.

The cut-off for each cylinder is variable by hand wheel. That of the high-pressure cylinder is controlled from the engine-house floor, but that of the intermediate and low-pressure cylinders can only be varied at the cam shaft level. The gearing for each cylinder is a self-contained unit. The exhaust valves on all the cylinders are operated by a single cam of simple design by means of which the positions of release and compression are controlled. The operating mechanism is similar to that for the steam valves.

FIG. 10—AERIAL VIEW OF THE KEMPTON PARK WATERWORKS

Lubrication has evidently received very careful attention, as indeed was very necessary, since the engines will run continuously for long periods. The oil for lubricating the cylinders is stored in a tank in the engine-room basement and is forced by an electrically driven rotary pump to a small tank on the top platform. This tank is the upper of the two circular tanks which may be seen between the high and intermediate cylinders in the view showing that platform, Fig. 11. The pump is controlled from that level so that it can be started and stopped as required. The cylinders are supplied with oil by separate mechanical sight-feed lubricators of twenty-six points, which are driven from the valve gear lay shaft, each lead being capable of fine adjustment. The engine

KEMPTON PARK PUMPING STATION—NEW PUMPING ENGINE

FIG. 11—CYLINDER HEADS AND VALVE GEAR LAY SHAFT

lubricating oil, which is also stored in the basement, is pumped in a similar manner to the lower of the two circular tanks on the upper platform. From that tank it is fed by gravity to distributing pipes arranged beside each cylinder, and these pipes are fitted with over 200 needle valves which have fine screw adjustments. Each valve carries a plate with the name of the point with which it deals engraved upon it. The drops of oil coming from all the valves are always visible, and their rate can be controlled by the screw adjusters. A good idea of the neatness with which the pipes which run to the various points to be lubricated have been arranged may be obtained from Fig. 11. At each point of lubrication the oil is collected and led down to the basement, and from there it is pumped through a filter to the overhead storage tank. The main bearings are lubricated by oil aquariums with glass windows and adjustable sights.

The machining of the engine parts is first-rate, and the massiveness of the various portions of the engine structures is very impressive. Everywhere the excellence of finish is most noticeable, and in no part is it more so than in the planished sheet steel lagging, which, as with the pipe work, &c., in the boiler-house, encases the cylinders, receivers, steam and exhaust mains, &c. There are two small steam barring engines arranged at crank shaft level, which, tiny though they look beside the giants which they can put into motion, are, we gather, able to start the pumps against load and to keep the engines revolving at the rate of one revolution in three minutes. There are two feed pumps for each engine. They are fixed in the basement above the pump platform and are driven from the high-pressure cylinder pump crosshead by links. They are single-acting and have a capacity 50 per cent. in excess of the steam required by the engine under maximum load. Driven by each engine are also the condenser air pumps, an air compressor for charging the pump air vessels, and the oil pumps of which mention has already been made.

Of the main pumps not much need be said, for, except in capacity and in the fact that, as has already been explained, they have compound plungers, they present no features which differentiate them greatly from the pumps in others of the Board's stations. The whole of the pump work which is subjected to the delivery pressure—that due to 400ft. head—is of cast steel. The condensers are of the surface type, the cooling being effected by the water as it passes from the pumps into the mains. Each engine has its own condenser, and the condensers are conspicuously small in appearance when compared with the enormous bulk of the engines, the exhaust from which is dealt with by them. It has to be remembered, however, that, large though the engines are, they do not, owing to their slow speed, develop much in excess of 1000 horse-power each, which is, of course, small when compared with the powers dealt with by some of the gigantic condensers which are to be seen nowadays in modern electric generating stations, for example. We may add that the guaranteed steam consumption of the engines is only 9·875 lb. per pump horse-power-hour.

As in the boiler-house, the equipment of gauges in the engine-house is most complete. Those of the recording type are arranged in the small room between the engine and boiler-house, to which attention has already been called; those necessary for the actual running of the engines are on the "A" frames near the starting hand wheels. The others are on the other frames and on the walls of the engine-house. An electric alarm gives warning to the staff that an engine is about to be started, and at various parts of the engine-room as well as on the engines there are quite small hand levers, by the turning of which through a right angle—an operation which requires practically no force—the vacuum of either pumping engine may be instantly broken and the engine brought to a standstill. The equipment also includes, for each unit, an electrical instrument which exhibits a green light when the proper level is maintained in the suction well and pressure is maintained in the pumping main. When either is reduced a red light is shown. There are in addition two gauges, one for the delivery main from each engine, which show the pump horse-power at which each engine is working. Close to them are dials which show the efficiency at which the engines were operated during the previous month, the reservoir level into which each engine is pumping, and the steam flow to each engine.

Among other auxiliaries may be mentioned first of all an electrically-driven two-stage air compressor to draw air either from the engine-room or the condenser of either engine and to deliver either to atmosphere in the engine-room or to the air charging main. Then, too, there is an electrically driven centrifugal pump having a capacity of 10,000 gallons per hour for keeping the basement clear of water. The motor driving this pump is fitted with an automatic starting and stopping gear which is controlled by a float in the suction sump.

We have, in the space at our disposal, only been able to give quite a cursory description of this most valuable addition to the Water Board's system, which, in many ways, is among the most interesting of its pumping stations. Much more might have been written concerning it, but enough has been said, we trust, to enable our readers to form some idea of the general scope of an installation which is, in every detail, of the most up-to-date character and which should be capable of operating at an efficiency as high as, if not higher than, any comparable waterworks in the world.

It will be of interest, perhaps, to give figures as to the approximate cost of the plant. They are as follows:—

	£
Buildings—pumping station, filter-house, &c.	164,000
Machinery, including engines, pumps, boilers, coal and ash-handling plant, &c.	132,000
Primary filters and accessories, chlorinating plant, &c.	81,000
Main laying, suction tank, &c.	70,000
Total	£447,000

In conclusion, we desire to express our thanks to Mr. Stilgoe for allowing us facilities for inspecting the Kempton Park pumping station, and for providing us with the necessary particulars from which the foregoing description has been prepared, as well as for the drawings and photographs with which our article has been illustrated. We also desire to thank those members of Mr. Stilgoe's staff and those of the contractors' staffs with whom we have come into contact for the welcome assistance they have afforded us.

The Institute of Fuel.

No. I.

THE annual two-days' Conference of the Institute of Fuel—which has now become a regular feature of the engineering institutions' session—was held at the Institution of Mechanical Engineers, Storey's-gate, London, on Thursday and Friday, October 24th and 25th. The new President, Sir David Milne Watson, who follows the Founder-President, Lord Melchett, presided at the opening meeting on Thursday morning, October 24th, and delivered a presidential address, from which we printed long extracts in our last issue. The better plan was adopted this year of not overcrowding the meetings with papers, and as those presented were read only in short abstract, there was a better opportunity for adequate discussion. A special welcome was given by Sir David Milne Watson to Mr. Carl J. Jefferson, who is head of the Fuel Conservation Section of the United States Shipping Board, and has come over to this country specially to attend the Conference in that capacity, and also as representing the Fuel Division of the American Society of Mechanical Engineers and the American Society of Naval Architects and Marine Engineers.

Proposing a vote of thanks to the President for his address, Dr. E. W. Smith took the occasion to mention the position that has arisen as between the gas industry and the coke oven industry in regard to the supply of coke oven gas for public purposes, and warned the coke oven industry that it could not expect to

come into that supply and reap all the benefits of the pioneer work of the gas industry in creating a market for the use of gas for more than a century without equitable arrangements being made with the gas industry.

In the afternoon of Thursday, October 24th, four papers dealing with pulverised fuel for marine type boilers were read.

Pulverised Fuel at Sea.

The first paper was by Mr. Carl J. Jefferson, head of the Fuel Conservation Section of the United States Shipping Board, who explained the work of that body, which is composed of representatives of various technical societies. It was stated that the reasons why the subject of pulverised fuel for marine purposes had been investigated by it was the high price of fuel oil and the prospect of its increase. The problem was first attacked in the laboratory, and an equipment was installed at the Philadelphia Navy Yard under the joint supervision of the United States Navy and the Fuel Conservation Section of the United States Shipping Board. That work was begun in 1925, but it took as a starting point the large amount of experimental work that had been carried out in America previously by various people. The laboratory results thus obtained were adopted as the basis of design for service installations. Mr. Jefferson said, that up to date, all American pulverised fuel marine installations had been applied either to existing boiler plants or to marine boiler plants of orthodox design. Thus, the situation was one in which the pulverised fuel had been made to fit the boiler, and not the boiler designed for the use of pulverised fuel. The first water-borne pulverised fuel installation actually placed in operation in America was on the tow-boat "Illinois," which was in service on the Mississippi River, but that installation did not differ greatly from that found in a number of shore plants. The first vessel operated in off-shore trade and the first vessel to cross the Atlantic with pulverised fuel was the ss. "Mercer," a 9700-ton vessel originally fitted out as an oil burner, but converted to pulverised fuel by the United States Shipping Board. Up to the present, the "Mercer" had made eight Transatlantic trips, and had demonstrated the feasibility and reliability of pulverised fuel for marine purposes. The results of the original voyages of the "Mercer" were sufficiently satisfactory to warrant drawing up plans for six additional conversions, but at that moment there was a marked decline in the price of fuel oil, and the United States Shipping Board secured a three-years' fuel oil contract at a remarkably low price. It was therefore decided to set aside, for the time being, the idea of the six additional conversions, and to use the funds thus rendered available for further development work.

The paper gives an account of the equipment of a number of other boats, of which practically all have been described in The Engineer.

The second paper was presented by Engineer Rear-Admiral W. M. Whayman. It describes the experimental work which has been carried out at Renfrew by Babcock, Wilcox and Co., Ltd. The results are considered sufficiently promising to warrant the extension of the experimental work at Renfrew on a larger scale, and a modern high-pressure water-tube boiler with superheater and air heater and pulverised fuel firing plant of size and capacity suitable for an up-to-date cargo steamer is now in course of erection. It is the aim, said Admiral Whayman, to demonstrate at Renfrew that the position of coal as fuel for marine purposes is still a strong one, and possibly unassailable if a modern plant of steam propelling machinery in association with water-tube boilers using moderately high pressure and temperature is used.

In the third paper Mr. Harold E. Yarrow dealt with experiments that have been carried out by Yarrow and Co., Ltd., at their works with the object subsequently of applying the results to actual sea-going practice.

The final paper by Mr. E. W. Green and Dr. G. E. K. Blythe discussed the progress that has been made in the application of pulverised coal firing to marine boilers. The authors pointed out that, although there had been some criticism that too much had been said and too little done in the application of pulverised fuel to marine installations, there was to-day afloat a ship specially designed and arranged for the use of pulverised fuel for steam generation purposes, viz., the ss. "Berwindlea," whilst the ss. "Hororata," "Stuartstar," "Mercer," "West Alsek," and others were playing a very important part in the development of pulverised coal firing as applied to marine work. Whilst very little was being said of anticipated developments, marine engineers need not be pessimistic, or impatient for fully detailed results. They would be forthcoming in due course.

The paper made special mention of the "Hororata," which up to date has completed a journey of 54,000 miles, with a coal consumption of over 10,000 tons. Throughout her various voyages the scheduled sailing dates have been strictly adhered to, and no trouble of any magnitude had been experienced since the vessel left London in December, 1928. The "Hororata" is equipped with two stokeholds, each containing three single-ended boilers of four furnaces each. As a precautionary measure, the original furnace fronts have not been tampered with, so that the owners could at any time revert to ordinary coal firing in from two to three hours. Although much had been said and written relative to the uncleanliness of pulverised coal firing, the forward stokehold of the "Hororata" had been, throughout her voyages, as clean as that of an oil-fired ship, and formed a striking contrast to the general conditions obtaining on the hand-fired after-stokehold, which, by the way, is to be converted to pulverised fuel firing, owing to the success that has been obtained with the forward stokehold.

There was a lengthy discussion on these papers, over which Sir Westcott S. Abell presided.

Sir Westcott Abell, commenting on the subject generally, said that it seemed to him that unless there was a *prima facie* saving of 20 per cent. in operation, including interest on capital and depreciation, there was little encouragement for a shipowner to embark on a pioneer problem involving such difficulties as those mentioned in the various papers. The competition was between the simple pulveriser without a crusher and some form of grate stoker, and, on the whole, he felt the possibilities seemed to be in favour of the grate stoker, provided the boilers were suitable.

Mr. J. Hamilton Gibson commented on the frankness of the authors in drawing attention to the difficulties that had been met in dealing with this problem, and urged the necessity for simplifying the gear used for pulverised fuel firing, cutting out, for instance, the crusher and automatic conveyors between bunker door and pulverising hopper. Even with "run-of-mine" coal it should not be difficult for firemen to break large coal sufficiently to enable it to be used, without the necessity for a crusher.

Admiral Scott Hill also expressed the view that too much was being made of a little handling of the coal before use in pulverised fuel plants, in order to keep the plant as simple as possible.

Mr. Hollands referred to the dust problem with pulverised fuel, and said he believed that when the "Mercer" arrived at Rotterdam she was covered inches thick with carbon and dust—hardly a pleasant thing for passengers. In the light of that kind of trouble he wondered whether pulverised fuel would really do better than mechanical stokers. It seemed advisable to give serious consideration to stokers before rushing into complicated systems involving means for drying, crushing, pulverising, screening and handling fuel which could be burned under boilers with equal efficiency and without all the mass of machinery necessary for pulverised fuel which was so illplaced in a ship's boiler-room.

Mr. E. K. Regan suggested that the pulverised fuel problem was studded with bogeys, half of which had never materialised. Those that had materialised had been due mostly to inexperience and through the plant having been put into the hands of people ill-equipped technically or with instruments. He suggested the possibility of using the low volatile coals in pulverised fuel plants and more uniform grinding—not necessarily finer grinding. Land practice had demonstrated the practicability of using the lower volatile coals.

Dr. C. H. Lander, Director of the Fuel Research Board, expressed appreciation of the manner in which the Americans had placed information regarding the use of pulverised fuel at the disposal of the world in general. Speaking on the general question, he expressed the opinion that the desired results could be obtained by abandoning the idea of turbulence in the use of pulverised fuel, and he mentioned a type of burner that had been designed at the Fuel Research Station, absolutely from first principles.

Mr. Harald Neilsen criticised the design of the various powdered fuel burners that are available, and said it was better to cause an intimate and intensive mixture of the fuel and air for combustion before the mixture entered the combustion chamber, and then permit the mixture to enter under stream-line conditions, and so obtain very rapid and complete combustion. He did not believe that any amount of turbulence assisted very much in combustion. Similarly, the old ideas of high flame temperatures in the furnace were not now considered correct; the essence of the whole thing was to have the B.Th.U's. evolved absorbed as rapidly as possible, and to maintain a flame temperature sufficiently high for quick oxidising.

Mr. Edward Green, replying to a few criticisms made during the discussion, advocated the use of the crusher which, he said, was inexpensive and did not occupy much space. He would like to see the fireman who could crush coal by hand and leave no piece, say, over 1in. square. It was essential to have the coal of a uniform size to get the best results.

Mr. J. F. Petrie spoke of the competition with British cargo vessels of much second-hand foreign tonnage on which the insurance rates were very low, and which had a considerable advantage over British vessels which maintained regular sailings. If, by the use of pulverised fuel, the amount of coal necessary could be reduced for any particular voyage, that meant so much more cargo space and a greater ability to compete with this second-hand tonnage to which he had referred. That result would be the more quickly achieved if cleaner coal could be obtained, as that also would reduce the quantity of fuel to be carried.

Mr. H. Clifford Armstrong expressed surprise that the coalowners were not working more closely with the shipowners in developing the use of pulverised fuel. Coalowners complained that they could not sell their coal, and yet they did practically nothing to help the development of pulverised fuel, notwithstanding the number of vessels that were being converted to burn oil and the number of motor ships that were being built. As to washing coal, it seemed to him that ash was being taken out and something nearly as bad, viz., water, put in, with the result that grinding costs went up. What caused more trouble than anything else was the grinding problem.

Mr. Harold Yarrow, in his reply, mentioned the case of a colliery owner who, when asked to subscribe to a scheme for the better utilisation of coal by pulverisation, said he would have nothing to do with it, because it aimed at reducing the quantity of coal used for any particular purpose.

Engineer Rear-Admiral Whayman, who also briefly replied, said that one of the objects of the new experimental work at Renfrew was to see what could be done in the way of higher heat liberations in the furnaces of marine boilers than was customary in shore practice. It had been found that it could be done, but there were appreciable difficulties.

Mr. Carl Jefferson, who made the final reply, refuted the suggestion that the "Mercer" was covered with soot and dust. The vessel would shortly be in at Manchester, and he invited any people interested to see for themselves. One reason why there might be some dust on the boat was that she was built for war service and for low visibility, so that the decks were very low, and the funnel was so placed that going against a head wind every bit of dirt from the funnel was carried down on to the ship. Giving a few figures of the results obtained on the first voyage of the "West Alsek" with pulverised fuel firing as compared with hand firing, he said the speed was increased from 8·68 to 9·46 knots, the quantity of coal used was reduced, as was the cost per mile, whilst the labour cost with twelve men as against nine with hand firing was also less. He asked anybody to try and see how he got on if he tried to use big coal on a pulverised coal plant without a crusher. Finally, Mr. Jefferson said that he appreciated the opportunity of speaking to British engineers and delivering a message from American engineers, and extending the hand of fellowship. He expressed the hope that it would be possible for engineers in the two countries to reciprocate more and more in regard to fuel and other matters.

The Conference then adjourned until the following day.

ANNUAL DINNER.

The annual dinner of the Institute was held at the Connaught Rooms on the evening of Thursday, October 24th, with the President, Sir David Milne Watson, in the chair. The principal guest of the evening was the Lord Privy Seal, Mr. J. H. Thomas, who proposed the toast of "The Institute." Referring to the origin of the Institute, Mr. Thomas asked why it had taken so long to bring into being a body which was so necessary and essential to our country to-day. The fuel industry was no different from any other industry and there must be a pooling of brains and ideas which would enable it to adapt itself to modern conditions and circumstances. In this country, which had established a higher standard of living than that in other countries, £800,000,000 had to be found each year in order to pay for essential commodities which had to be obtained outside the country. If prosperity was to be maintained, it was necessary that exports must be increased, and in the fuel industry, which was the key to all other industries, organisation must be a characteristic note in future development.

In replying to the toast, the Chairman, Sir David Milne Watson, remarked that the progress of the Institute might be gauged by the increased attendance at the dinner, which was 50 per cent. larger than that of last year. If our nation was to prosper, it was very necessary that the fuel industry should again lead and come to the top. The toast of "The Visitors" was proposed by the Founder-President, Lord Melchett, who emphasised the importance of producing oil from coal. In the works with which he was associated, research had, he said, enabled them to produce excellent motor car spirit from Durham slack, and he felt sure that this particular line of development had enormous economic possibilities. Replies to this toast were made by Mr. Carl Jefferson, the Head of the Fuel Conservation Section of the United States Shipping Board and the official representative of the American Society of Mechanical Engineers, Naval Architects and Marine Engineers, and Dr. A. E. Dunston, the President of the Institution of Petroleum Technologists. The toast of "The President" was submitted by Sir Henry Fowler.

Over 450 members and guests were present, including many ladies, and after the more formal proceedings were ended, the floor was cleared for dancing and a cabaret entertainment. All arrangements were most excellently carried out, and a very pleasant evening was spent.

(To be continued.)

A new telephone cable, 335 miles long, from Paris to Bordeaux entirely underground, has been put into service. The new cable, which cost about £1,520,000, is part of a national scheme, of which the first link, from Paris to Lyons and Marseilles, was put into service recently.

Motor Show at Olympia.

No. III. (*Conclusion*).*

THE Show at Olympia concluded on Saturday last, and although the number of visitors who passed through the turnstiles was considerably smaller than at last year's Show, namely, 227,000, compared with 253,000, the promoters have good reason to be satisfied because several of the makers of the popular cars had shown their new models prior to the Show. The success which has attended the holding of these annual displays is no doubt largely due to the policy adopted by the motor trade of concentrating all its efforts into one comprehensive exhibition. In our previous reviews we alluded to the leading features which are to be expected in British cars next year, and ventured to predict that the prices had reached "rock bottom." This prediction is substantiated by calculations made by the Society of Motor Manufacturers, which show that on a gold basis there is a reduction in favour of present *versus* pre-war prices of just over 50 per cent. in the case of motor cars, without taking into account the value of accessories and fittings, which were not included in pre-war machines.

We have already referred to the great improvements which have been made recently in braking systems, the importance of which grows with the increasing road speeds. For many years it has been known that all cars must have two independent brakes, but there has been much confusion as to what such a requirement actually means. It is quite likely that there are cars on the road which do not comply with legal requirements in this respect. It is therefore satisfactory to learn from Mr. Herbert Morrison, the Minister of Transport, that a new Order will come into force to-day—Friday—which will simplify the position. This Order states that a motor car may now be fitted either with two entirely independent braking systems or with one braking system having two independent means of operation, so designed that failure of any single portion of one system will not prevent the brakes on two wheels from operating effectively. The same operating cross shaft may be used for both systems. With regard to the servo-operation of brakes, the new Order specifies that at least one set of brakes must be applicable by direct mechanical action without the intervention of any hydraulic, electric, or pneumatic device. With such clear definitions there can be no excuse on the part of manufacturers who do not comply with the requirements of the law in future.

"BABY" CARS.

Amongst the popular "baby" cars the "Triumph" has attained a place of distinction, both for design and performance. Seven different models of this firm's manufacture were shown. The chassis specification is generally similar to that of the 1929 model. The engine has four cylinders and side-by-side valves. The dimensions are 56·5 mm. by 83 mm., the cubic capacity being 832·24 c.c. The R.A.C. rating is 7·9 H.P. and the annual tax is therefore £8. The cylinders are cast in one with the crank case, which is split horizontally below the crank shaft centre, so as to make the big end bearings and the connecting-rods readily accessible. Die-cast aluminium pistons are used, these having three rings with the bottom ring arranged as a scraper. Lubrication is by pressure feed to the three-bearing crank shaft and the big ends, a spur gear oil pump being situated in the sump and feeding through oil-ways drilled in the crank case. The carburetter is a Zenith, and ignition is supplied by a Lucas magneto. The gear-box provides three forward speeds and is built in unit with the engine. The ratios for the two and four-seater tourers are 5·75, 10·46 and 18·71, slightly lower ratios with a direct drive of 6·25 to 1 being used for the saloons. Suspension is by means of semi-elliptic springs in front and quarter elliptics in the rear, shock absorbers being fitted all round. The brakes are hydraulically operated. They are smooth, progressive and powerful. Incidentally, the "Triumph" is said to be the only car of its class which embodies this refinement. The steering is by worm and wheel with provision for adjustment. Thermo-syphon and fan cooling are provided.

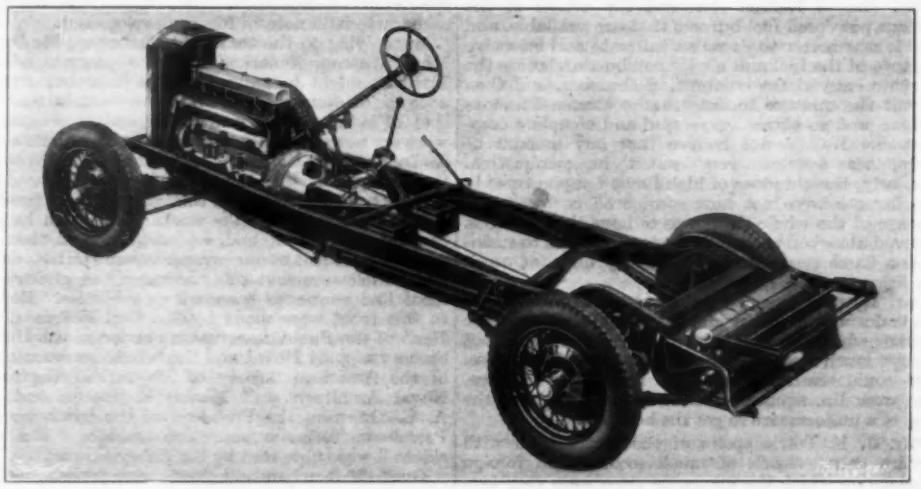


FIG. 18—CHASSIS OF 6-CYLINDER "SNIPE" CAR—HUMBER

HUMBER.

We are enabled to present this week two views of the Humber Snipe chassis and engine in Figs. 18 and 19. This chassis was described in our last issue.

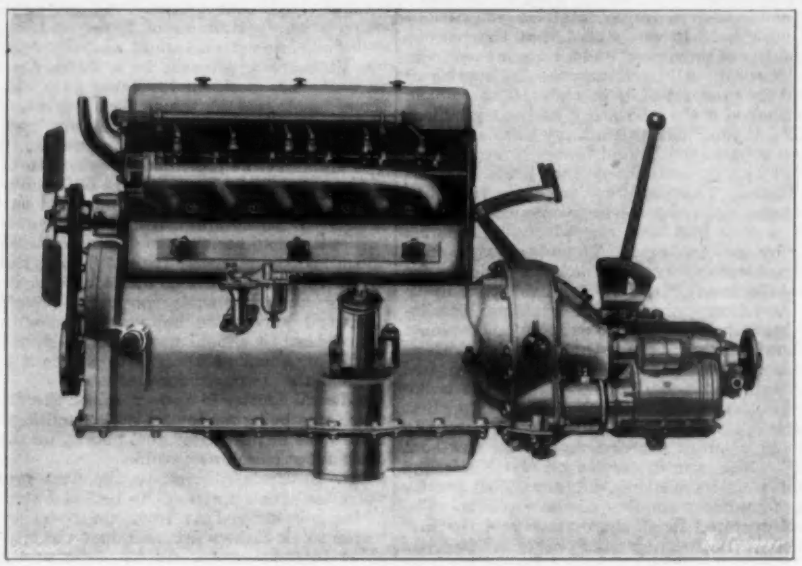


FIG. 19—6-CYLINDER ENGINE OF "SNIPE" CAR—HUMBER

LANCIA.

In the new Lancia eight-cylinder "Dilambda" model the manufacturers have endeavoured to retain and improve upon the well-known special qualities of their Lancia "Lambda" model, which has been in regular production since 1922. At the same time, improvements resulting from experience, and from progress which has been made in automobile development have been introduced. One of the principal characteristics of the "Lambda" model, to which we have previously referred, is the independent front wheel springing, which enables the weight of the unsprung parts to be reduced to a minimum. This suspension, whilst providing the maximum of comfort, gives great stability and road-holding qualities, even at very high speeds and on sudden and violent braking, regardless of the road surface.

In the new "Dilambda" model this Lancia suspension has been embodied on strengthened and improved lines. The lubrication is now entirely automatic, the moving parts are protected, and the whole suspension is simplified. The rear suspension is by two leaf springs and there are two shock absorbers, the spindles of which are mounted in rubber bearings which require no greasing or cleaning. The steering has been further lightened and the power of the brakes has been increased. The brakes, which are auto-compensated, are controlled independently by hand and by foot.

Owing to the Lancia special arrangement of Hypoid gears in the back axle, arranged in a way which enables the main driving shaft to be kept in a specially low position in relation to the back axle casing, the chassis itself is low.

To meet present-day requirements an eight-cylinder engine is fitted. The valves are operated by rods and the engine is of small overall dimensions, owing to the special construction. Thus, the chassis of average length provides the maximum of body space on account of the exceptional shortness of engine unit. This engine permits of the use of a crank shaft which is exceptionally short for an eight-cylinder engine, and is rigid and free from vibration without the addition of anti-vibration devices.

To aid in the silent running of the engine the distribution gear is operated by automatically tensioned chains. The moving parts have been reduced to the lowest possible weight, so as to minimise the load on the bearings. The fuel feed is by two electrically-operated pumps. The engine lubrication system includes a special automatic device which ensures the supply of constantly purified and cooled oil. A filter of the "Autoclean" type is installed in the circulation system. It can be very easily and quickly cleaned by turning a small lever on the top of the filter itself. The engine cooling is governed by a thermostat, and the air fan is direct driven by the cam shaft without the use of a belt. The clutch, which is of the mono-disc type, is very light and gives a smooth transmission to the gear-box, which has four speeds and a reverse. The chassis frame, which is exceptionally rigid, is composed of two side members, the rear cross member of which serves at the same time as the petrol tank. A system of central lubrication is installed. By a single pressure of an accessible pedal, oil is supplied to the moving parts of the front suspension and to all other parts of the chassis.

A NEW PISTON.

Aluminium or aluminium alloy pistons are now almost general. Owing to their high conductivity, overheating is prevented and the weight of the reciprocating parts is reduced. Troubles are, however, not unknown with pistons made of this metal owing to their higher coefficient of expansion. The B.H.B. self-adjusting pistons shown in Fig. 20 and exhibited by the Automotive Engineering Company, Ltd., Twickenham, consist of two parts, namely, the head or ring carrier and the skirt or guide block. These parts are connected by two inclined struts running from the gudgeon pin bosses towards the centre of the crown. The skirt is split and the downward thrust of the explosion tends to open it and obviate what is known

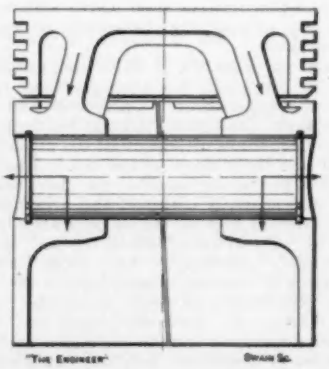


FIG. 20—B.H.B. SELF-ADJUSTING PISTON

* No. II. appeared October 25th.

as piston slap caused by the piston tilting in the cylinder, and rattle due to excessive clearance brought about by wear of the cylinder walls. The expanding capacity of these pistons can be adjusted by varying the inclination and strength of the inclined struts. The makers claim that with this type of piston greater tolerance in fitting clearance can be allowed than with ordinary pistons. A further claim made is that the self-adjusting characteristics of the piston make it particularly suitable for replacement purposes when cylinders are slightly worn.

David Brown and Sons.

In addition to its usual range of exhibits of worm and spiral bevel rear axle gears, steering, transmission and timing gears, this Huddersfield firm showed an Amherst-Villiers supercharging unit of the Roots blower type. A general view of this device is given in

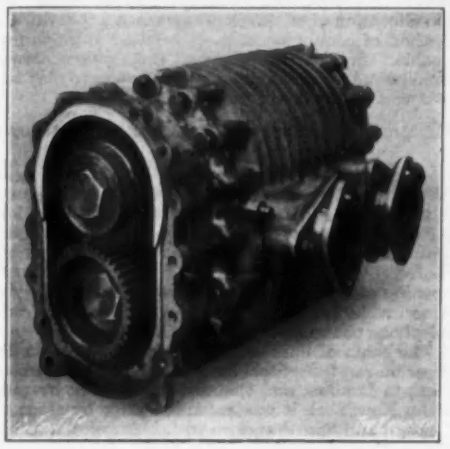


FIG. 21—AMHERST-VILLIERS SUPERCHARGER—BROWN

Fig. 21. The two rotors are mounted in an aluminium cylinder which has inlet and outlet branches for the air as well as fins for cooling purposes. The rotors have ground generated profiles. They are mounted on stiff shafts which are driven by heavy cut spur gear wheels. Another exhibit by this firm was a worm gear differential unit, shown in Fig. 22. This arrangement has been specially designed as an under-

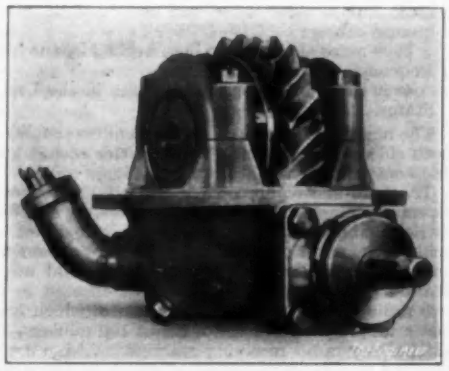


FIG. 22—DIFFERENTIAL WORM GEAR—DAVID BROWN

slung drive in conjunction with banjo type of axles. This type of drive enables a very low floor level to be adopted.

Bendix Brakes.

Whilst many engineers have improved the method of applying the power to brakes, the Bendix firm has improved the brakes themselves. The main principle of the Bendix brake is that the shoes are fully floating, which, it is claimed, allows the whole area of the brake lining to come into effective contact with the drum. The method of anchoring the shoes creates a self-servo action. When the pedal is applied the primary shoe is forced against the drum. Friction tends to carry the shoe round and to force the secondary shoe still more tightly against the drum, so increasing the braking effect. The faster the car is travelling the greater is this self-energising action.

Another advantage claimed is that, since each wheel applies its own energy to the brake shoes, the whole system is automatically compensated for varying road surfaces or for differences in the gripping qualities of the tires. Thus, it is stated, less braking power is actually applied to a wheel with a worn tire, or to a wheel running on a glazed surface, than to one with a good tire or one running on a good gripping surface. This tends to reduce skidding.

Institution of Electrical Engineers.*

In considering to what particular subject I should direct your attention to-night, I have not been unmindful of the sound old adage that the cobbler is generally well advised to stick to his last, and, on that principle, I propose to say a little on some aspects and activities of the engineering of electrical communications that have contributed to the wonderful expansion of the range of telephony which has taken place since the last reference was made to the subject in an address from this chair on the occasion of Mr. Gill's inaugural address in 1922.†

At that time the only places abroad with which a British telephone user could communicate were Paris and Brussels. To-day one can speak from this building, or from any other telephone in this country, to nearly 90 per cent. of the telephone stations of the world, and the statement that speech has been interchanged between any two points on the surface of the globe is no longer sensational. The problem of world-wide telephony has now advanced to that of providing public services in such a way that they can be depended upon to operate as and when required by the needs and convenience of the users.

Telegraphy and Telephony.

The present position of the telegraph service in this country is most interesting, and might well have supplied the material for an address, but I shall have to leave it untouched and pass at once to the branch of communications engineering which at the present day provides the most extensive field of operations, namely, the transmission of human speech by the public intercommunicating telephone. It is a branch which involves particularly intimate relations between the supplier and the user of the service. The concern of the public in its efficiency is direct and personal. Any failure to provide without delay for the easy interchange of conversation, on business or pleasure, with any desired correspondent is a flagrant failure of function which may sometimes be excused but can never be concealed. As a result, public telephone services are generally carried on in a stimulating atmosphere of critical vigilance on the part of the users, and this country is assuredly no exception to the rule.

The Automatic System.—At the present day the installation of full automatic systems, in which even the selection and interconnection of the lines is performed by electro-magnetic machines, is being pushed forward with increasing momentum all over the world, and in all kinds of localities from the smallest villages to the largest cities with improved results in the economy and quality of the service—sometimes, unfortunately, obscured to some extent by the occasional special difficulties of the transition period in large areas where the change-over has to be made in more or less piecemeal fashion. Twenty-one large exchanges, with an aggregate capacity for about 132,000 lines, have already been brought into service in London, in addition to the main junction switching centre, known as the "Mechanical Tandem" Exchange. The provision of twenty-six further exchanges, with capacity for about 125,000 lines, is now in hand, and it is expected that equipment for about 50,000 lines will be added annually to the London automatic system until the conversion of the area, which at present has a total of about 650,000 working telephone stations, is completed and all the manual exchanges are removed. In order to effect plant economies, it is proposed to provide auxiliary automatic tandem switching centres and an automatic switching centre for "Toll" circuits is also contemplated. It is anticipated that in seven years' time the number of automatic exchanges in the Central London business area will have reached 100, leaving only five manual exchanges for subsequent conversion. This great grafting and transforming operation—one of the greatest and most complex ever attempted in the electrical field—has necessarily to be carried through while the London telephone organism continues to perform without interruption its function of providing service to all its subscribers by day and by night, and I can say quite definitely that the difficulties and mishaps which have so far been experienced have been considerably less than one was inclined to anticipate at its inception.

The Telephone Exchange System.

It may be mentioned here that in this country as a whole we now have 163 automatic exchanges in operation in urban areas, with an aggregate capacity of about 300,000 lines—say, 500,000 stations—and that the planning and construction of 126 further exchanges is at present in hand. The manual system remains in use at the present moment at 487 exchanges, having a capacity exceeding 300 lines, and at 3790 smaller exchanges, serving, in all, about 1½ million stations; and exchange equipment of the automatic type capable of serving about 100,000 lines is being installed annually. It is of interest to record that at the present rate of development one new public exchange and about 1000 new telephones are installed for each working day throughout the year. Rural exchanges have, until quite recently, been entirely manual, but automatic equipment for exchanges serving small communities has now been designed on a basis which promises favourable economic results, and a start has been made in its installation. Up to the present, sixty such village automatic exchanges have been brought into operation and about 110 more are in hand. The minimum exchange unit provides for twenty-five lines, and further units can be added up to a maximum of 200 lines. They are accommodated in simple, extensible buildings of the "garage" type and are left unattended. A maintenance man normally visits them about once a week for the purpose of attending to the power plant, renewing the supply of calcium chloride by which the air of the building is maintained in a dry state, and making a general maintenance inspection. One important advantage of these small automatic exchanges is that they provide an all-night service, both locally and to the outer world, *viâ* junction lines, to the nearest "parent" exchange. The expense of providing night attendance at village exchanges of the manual type is invariably out of all proportion to the insignificant number of night calls to be dealt with, and is generally prohibitive.

Telephone Development.

The number of telephones in use in Great Britain is far smaller than it ought to be in a great commercial nation such as this, and, unfortunately, the same remark applies to the amount of use made of the telephones actually in service. Village exchange lines cannot be expected to originate much traffic, but it is very disappointing to find that the total traffic originated at exchanges having 300 lines and upwards only amounts to an average of 5·3 calls per line per day, which is much below the average in many other countries, and it shows no tendency to rise. This cannot be attributed to an unsatisfactory grade of service, because the quality of the service given in this country has for several years been good and the call fee is low. Reluctance to hire a telephone and to use it after it has been hired, may be a British characteristic, but I am quite sure that it is not an unchangeable characteristic. Much evidently remains to be done to bring home to the minds of our citizens the manifold business and social services which the telephone can render.

The position of this country among telephone users will not be improved merely by pouring more capital into the system. This would be putting the cart before the horse, and the additional interest and other annual charges thrown upon the accounts would soon convert the business into a losing one unless the public market for telephones and telephone service were at the same time correspondingly stimulated. It is only upon the estimated results of new salesmanship expedients that increased expenditure of capital can be judiciously regulated and the additional plant required be made available neither too soon nor too late. The system already carries and maintains the margin of spare plant required to meet continued development at the present rate of about 8½ per cent. cumulatively per annum. This rate of increase is in itself a healthy one, and compares well with the progress which is being made in other countries, but it is not sufficient to enable Great Britain to retrieve its arrears of telephone development in a reasonable time.

The Post Office has adopted, and is continuing, various expedients to stimulate public interest in the telephone. Intensive personal canvassing, coupled with wide distribution of postcards and pamphlets, has recently been tried in a number of areas. It cannot be said, so far, that these efforts have achieved striking success, but the Post Office takes a hopeful view of the future, and has faith that the public will increasingly find the telephone a necessity, both in business and in private life.

Radio.

A vast new field was opened up by the production of Hertzian waves and their utilisation for communication purposes. The literature of the subject is well represented in the *Journal* of our Institution. Radio telegraphy, in which the alternative emission or cessation of simple waves, or their alternative tuning and detuning, sufficed for signalling purposes, was speedily followed by radio telephony, in which the simple fundamental wave is used merely as a medium or carrier on which the complex speech wave can be impressed by modulation and subsequently separated out again and restored to its original character by demodulating processes at the receiving end.

The most impressive public services performed by radio to day are those of the telegraph with ships at sea, which in the case of the Post Office station at Rugby is capable of reaching any properly equipped ship in any of the waters of the globe; the wonderful services of broadcasting throughout the world; and the Transatlantic circuits between London and New York, by means of which all the millions of telephone users in America and in Europe are now linked together and provided with the means of verbal communication one with another at any time desired.

The classic occasion last year on which this Institution and its sister Institution in the United States held a joint meeting, at a time arranged and announced long in advance, will be fresh in the minds of our members; and its significance will be best appre-

* Abstract of presidential address by Colonel Sir Thomas F. Purves, delivered on Thursday, October 24th.

† *Journal*, I.E.E., 1923, Vol. 61, page 1.

ciated by those of us who have had some experience of the chasing of far-distant radio stations, and of the exasperating way in which short and spasmodic periods of success are followed by relapse into the blank of failure.

The stability of the service between Europe and America depends primarily upon the "long wave" channel originally installed. This channel operates on a carrier wave of 5000 m. and radiates energy averaging about 60 kW. There are also two short wave channels using waves of the order of 16 m., 24 m., and 30 m., and radiating about 5 kW. This radiated power will shortly be increased to about 10 kW. The provision of a further short-wave channel is now in hand, and endeavours are being made to obtain the availability of a frequency in the crowded ether which will enable another long-wave channel to be established.

These radiated energies, both long-wave and short-wave, are very much more effective than similar amounts of energy used in ordinary broadcast practice.

In the case of the long wave it is possible to eliminate and suppress the bulk of the energy—consuming components of an ordinary radio-telephone wave, as used by all other radio-telephone stations, and to transmit only that part of the frequency spectrum essential to the reproduction of articulate speech. When a carrier wave is modulated by speech into a telephone transmitter each frequency component of the speech wave appears as two separate frequencies, one equal to the sum of the carrier and component frequencies and the other equal to their difference. The complex speech wave thus sets up two frequency side bands extending above and below the frequency of the carrier. Before the energy is amplified for radio transmission the carrier frequency itself, which is the main power element, is filtered out. One of the side bands, and the non-essential portions of the other, are also filtered out. There remains for amplification and transmission only that portion of one side band which, after treatment at the receiving end, will reproduce speech frequencies between 300 and 2500 periods per second. In this way the effectiveness of each kilowatt of radiated energy is increased about six times. By the use of highly directional receiving antennæ a great increase in the ratio of signal strength to noise admittance is secured, and an effective improvement factor of about 100 is introduced. A further improvement in efficiency is obtained by locating the receiving stations in regions which have been found to be comparatively free from "atmospherics." With this object the American receiving station has been established at Houlton, Maine. 600 miles from New York, and the British station has been located at Cupar, Scotland, 450 miles from London. It has been calculated that a further improvement factor of about 50 was obtained by shifting the receiving station from New York to Houlton. In the case of the short-wave channels the carrier waves and both side bands are at present radiated, but these channels have the advantage of directional transmission as well as reception. It results that the energy used in all the London–New York circuits is many thousands of times more effective than equivalent energy radiated on ordinary broadcasting principles from one of those places for reception at the other.

Since the establishment of the London–New York system more than 25,000 successful conversations have been effected. The present traffic from all sources at each side averages about forty-five calls per day, and the average duration of calls is about six minutes. The division of the traffic averages at this side :—

95 per cent. from the United States ;
4 per cent. from Canada ; and
1 per cent. from Cuba and Mexico.

At the other side they get :—

53 per cent. from Great Britain ;
34 per cent. from France ;
7½ per cent. from Germany ; and
5½ per cent. from other European countries.

The behaviour of the circuits is continuously supervised, and calls are classified as follows :—

Good : When conditions are normal and conversation is easy.

Fair : When additional time has to be allowed as compensation for interruptions.

Poor : When conversation is difficult and double time or more has to be allowed as compensation.

Ineffective : When the attempt to communicate intelligibly has to be abandoned.

As might be expected, conversations between America and continental nations, which would be comparatively easy between correspondents speaking the same language, are occasionally rendered bad or hopeless by language difficulties.

The classification of calls for the past three months between Great Britain and the Eastern States of America was 85 per cent. good and 15 per cent. fair. To the Western States and Canada the proportions were 76 per cent. good and 24 per cent. fair. The whole of the traffic handled was classified as 80 per cent. good, 19·7 per cent. fair, 0·2 per cent. poor, and 0·1 per cent. ineffective.

Although the general quality of the service may be regarded as satisfactory at the present early stage of Transatlantic telephony, I think it may with safety be said that the possibilities of further developments in the art of linking radio circuits with telephone lines are such that the commercial data so far provided by the Anglo-American service is very far from representing the ultimate grade of service which will be obtained from such circuits.

Contribution of Line Telephony to Transatlantic Radio Communication.

It is of interest to note that many of the special features of the Transatlantic radio system, on which it depends for its commercial success, are devices intimately connected with, and in some cases borrowed from, the developments of line telephony.

Thus the single side band system of transmission, used on the original long-wave circuit, was developed originally in connection with the high-frequency multiplex system of telephony over land wires. It is no exaggeration to say that without this system commercial long-wave telephony across the Atlantic would be an impossibility.

The radio circuit is set up on the principle of a four-wire telephone circuit, connectable at both ends to two-wire or four-wire extensions, and it thus has to conform to all the conditions associated with the linkage of land networks.

The voice-operated switching devices used on the radio circuit are fundamentally similar to the echo-suppressors evolved for use on long four-wire land circuits, but much special development has been necessary to meet the far greater cross-talk and interference difficulties of the etheric path.

While it can be said that the radio-telephone system owes much to telephone development, it, in its turn, is benefiting the development of line transmission because of its insistence upon the highest grade of design and construction in the land networks to which it has to be extended.

The Transatlantic Telephone Cable.

Notwithstanding the high degree of stability which has been attained on the existing group of Transatlantic radio-telephone channels, the system would gain greatly by the addition of a submarine cable channel to the facilities available. It has been felt that while such a cable would be so costly that, taken by itself, its provision would be financially impracticable, the expense could be justified in the case of a cable which formed part of a larger system, to which it would impart the valuable element of assured continuity of service and unchallengeable secrecy, as well as adding to the total traffic-carrying capacity of the system. The research laboratories of the American Telephone and Telegraph Company had succeeded in producing remarkable improvements in the construction of ocean telegraph cables by the development of new metallic alloys for inductive loading, known as "permalloys." Its engineers were thereby encouraged to tackle the problem of the ocean telephone cable, with the result that last year the company announced that the Bell Telephone Laboratories had evolved a method of deep-sea telephone cable construction which would be suitable for Transatlantic operation. Work is now going forward actively on the development of a cable of this type for connection between London and New York, and it is possible that this circuit will be available for service as early as 1932. The new cable will yield only one additional telephone channel, but it will be a circuit of maximum reliability, free from the variations characteristic of radio circuits. It is probable that a superposed telegraph channel will also be obtainable.

The route of the cable is not yet settled in detail, but it is probable that the main Transatlantic link will extend directly from Newfoundland to Ireland, a cable length of approximately 1800 nautical miles. From Ireland the circuit will probably be carried through submarine cable to Scotland and thence by land cable to London, where it will terminate. It is expected that from Newfoundland the circuit will be carried through several sections of submarine cable to Nova Scotia, and thence by land circuits through Nova Scotia, New Brunswick, and the New England States to New York City, which will be the other terminal.

The new cable will be of the continuously loaded type. For the loading material t is intended to use one of a new series of alloys which are designated as "perminvars." These are composed of nickel, cobalt, and iron, to which may be added small amounts of non-magnetic metals, such as molybdenum. The so-called "perminvars" are characterised by high resistivity and by a wonderfully constant permeability over a wide range of magnetising force.

The conductor will be insulated with a new dielectric material known as "paragutta." Submarine cables in the past have been insulated with gutta-percha or closely related materials, and in a few cases with rubber compounds. Paragutta makes use of similar raw materials and its mechanical properties are similar to those of gutta-percha, but the combination and treatment of its constituents endow it with superior electrical properties.

Imperial Telephony.

The great success which has been achieved in the Transatlantic radio-telephone service has led to investigations into the possibilities of opening telephone services with other distant systems, particularly with those of the British Dominions.

The first of these undertakings to take practical shape is communication with Australia. By the use of short waves an Anglo-Australian service of an experimental character has for some time been maintained, *viâ* the Post Office radio stations at Rugby and Baldock, working to corresponding transmitting and receiving stations near Sydney. It is hoped that a regular commercial service will be inaugurated very soon, and it is anticipated that this will shortly be followed by services to South Africa, India, New Zealand, &c. There is no doubt that direct communication will also be established ere long with ships at sea and with other remote countries where radio telephony installations are being operated or installed.

Restricted Ultimate Field of Radio.

The demand for radio channels is continuously increasing, but the number of frequency bands available in the ether is strictly limited. It is probable that progressive increase in travelling by sea and air, and demands for the connection of moving craft with the world's telephone network, may in future limit the allocation of ether space to purposes for which no method of communication, other than radio, is practicable. In that case many of the services between fixed points for which radio is now employed may have to revert to the use of wires and cables.

Maximum Distance Conversations and Power Used.

As an illustration of the fact that the dimensions of the earth's surface now set no bounds to the range of telephony, it may be interesting to mention a long-distance test conversation carried out in association with the United States by two of my officers who visited Sweden last year in connection with the opening of communication between that country and America by means of the Anglo-American radio-telephone channels of the Post Office.

The chain of lines set up and spoken over on that occasion ran from Stockholm, *viâ* Berlin and Amsterdam, to London, and thence to New York by radio. From New York it was extended stage by stage, *viâ* Chicago and San Francisco to Los Angeles, and back by another channel to New York, then once more to Chicago and back again to New York, with a final extension to the residence of one of the American Telephone and Telegraph Company's officials in New Jersey, from which a fair grade of conversation was exchanged with Stockholm.

The total length of the route traversed was about 14,000 miles, including approximately :—

270 miles of open-wire line in Sweden ;
200 miles in submarine cables across the Baltic and North Seas ;
1050 miles in underground cables in Germany, Holland, and England to London ;
3900 miles, London to New York, including the radio link of 3200 miles and 700 miles in underground cables ;
3860 miles of open-wire line, worked by the high-frequency carrier system ; and
4850 miles in underground cables in the United States.

The aggregate length of copper conductor used on both sides of the Atlantic to carry this record long-line conversation would be about 40,000 miles.

The land-line equipment comprised 117 four-wire repeaters, nineteen two-wire repeaters, twenty-four carrier-channel repeaters, and six cord-circuit repeaters, in addition to eight echo suppressors and numerous other special devices. The total amplification of power included also that effected in the two radio transmitting stations, each of which has a power amplification factor of about 100 millions, and at the two radio receiving stations, which may be required to amplify the received power to any extent between 30,000 and 300 million times in order to compensate for the extremely variable ether channel at different times and seasons.

The power amplification factor introduced at the radio transmitting and receiving stations—enabling the speech currents received over the land lines at the transmitter to be passed forward at the normal volume from the receiver to the land lines—will thus vary widely around a mean value of about 10^{16} (10,000 billions).

But the power loss made good by the repeaters on the wire line portion of the circuit—11,000 miles—would be immensely greater. The transmission equivalent of the chains of circuits used would not be less than 2400 decibels (240 Bels), and was probably a good deal more. The relationship of power sent to power received over a circuit of 240 Bels is a ratio of 1 to 10^{-240}.

It is permissible to think of the power which would be required to deliver currents of telephonic magnitude at the far end of such a circuit in the absence of repeaters. We start with an acoustic energy equal to about 10 microwatts delivered into the telephone transmitter by the voice of the speaker. The transmitter is itself an amplifier, and delivers about 200 times this amount of energy into the line in electrical form—say, 2 milliwatts. The receiver at the far end of the line will reproduce speech of minimum commercial volume with 1 microwatt. To deliver even 1 microwatt at the far end of a circuit of 240 Bels without intermediate amplification, the initial energy must have the inconceivable value of 10^{231} kilowatts. I believe that the power radiated by the sun is of the

MOULD LOFT AT MONFALCONE SHIPYARD

order of 4×10^{29} kilowatts, from which it appears that the number of suns required to feed our circuit with the necessary power would be $0{\cdot}25 \times 10^{202}$. If we are inclined to accept Hubble's estimate that the maximum possible number of suns within the "world-line"—the limiting curve of space—is 2×10^{24}, it follows that the whole radiant energy of nature would fall immensely short of meeting the requirements. We should need to multiply nature by 10^{177}—one might say "approximately"! It seems evident that the invention of the telephone repeater has tended to simplify certain problems!

Conclusion.

In attempting to review the present position and course of electrical communications engineering within the compass of a short address, it is necessary to leave many aspects of the subject untouched.

I should have liked to say something about the interests of power and communication engineers in the avoidance of interferences between one system and the other, and of the widespread studies and discussions which are now going on with a view to devising means by which the lion and the lamb will be enabled to live together in peace and mutual satisfaction.

The general subject of submarine cables is also in a very interesting position, and the same applies to broadcasting—both by radio and by wire—and to the successful efforts which are being made to use simultaneously, for one purpose or another, every part of the frequency spectrum which wires and cables are capable of transmitting.

The automatic telephone system also presents many developments which are worthy of note, particularly in the direction of long-distance automatic switching and signalling, and in the design and utilisation of really remarkable machines for automatically applying tests to the various parts of its intricate working plant, and facilitating its maintenance in proper condition.

There is much of interest, too, in the large programmes of line construction which are now being undertaken by telephone administrations all over the world with a view to the building up of systems that will adequately meet the needs of the future, and be worthy to take their place in an efficient and reliable world system of electrical communication. The underground cable networks of Europe are becoming notably more impressive year by year, and they will be increasingly linked with the great systems of America, where the United States expects, within the next five years, to have the Southern States, and those of the Pacific and South Atlantic coasts, connected by all-cable circuits with the main cable network of the Eastern States and the States of the Middle West.

I feel, however, that I have already inflicted enough at one time upon this audience of general electrical engineers, and these and many other aspects of communications engineering may well be left to future opportunities, and I hope, to many other and more competent exponents.

A Miniature Oil Can.—We have received from Joseph Kaye and Sons, Ltd., Leeds, a miniature polished copper valve oil feeder, which is a sample of a large order placed by Meccano, Ltd., Liverpool. It is a perfect model of the familiar "K" oil feeders with spring plunger complete, but holds not much more than half an ounce of oil. Model makers who desire to complete their equipments will be glad to know of it.

Shipbuilding at Monfalcone.

The visit paid by the members of the Institution of Naval Architects to the shipyard and works of the Cantiere Navale Triestino at Monfalcone on Saturday, September 28th, was an event of outstanding interest in the Italian Summer Meeting. The party was met and conducted through the various shops by Mr. Augusto Cosulich, the managing director, and by the members of his managerial and technical staffs.

The Monfalcone yard was founded in 1907, and from the time of its inception up to the outbreak of the war in 1914 its output steadily increased, reaching in 1913 a maximum of 32,400 tons. During the war years, both the yard and the works were completely destroyed by shell fire, and nothing remained of the ships left on the berths but a mass of twisted iron. The offices and workshops were completely demolished, and the yard itself was cut through with trenches.

Within two years of the end of the war, however, the yard was entirely reconstructed from its foundations, and by 1920 five ships had been launched, representing a total of 10,480 tons. In 1925 twenty ships were launched, aggregating 48,500 tons, and in the following year the output was increased to 50,450, one of the ships of that year being the 24,000 gross ton, 631ft. motor liner "Saturnia," for the Cosulich Line, Trieste. In the building of that notable vessel, the yard and its shipbuilding methods were considerably developed. Last year sixteen ships were built at Monfalcone, representing a total of 42,650 gross tons. At the time of the recent visit several steamships and motor vessels were under construction, and several Italian submarines were on the stocks.

The Yard Lay-out.

Originally the site on the shore of the Gulf of Panzano was chosen by Chevalier Callisto Cosulich, the promoter of the undertaking, on account of its close proximity to the neighbouring port of Trieste, and the fact that Monfalcone forms an important railway junction at which traffic from the north and south of Italy and from the south of Germany, Austria and Czecho-Slovakia naturally converges. Such an arrangement enables raw materials to be delivered at the yard at the lowest costs, while ships requiring repairs can call at the yard without a wide deviation from their ordinary commercial routes.

In the laying out of the yard, large spaces were set aside for plate and angle stock yards, and these are well served by overhead electric cranes equipped with lifting beams furnished with electro-magnets, enabling the required material to be transported to the platers' shops.

The slipways are eight in number, and the two largest of them accommodate vessels up to 856ft. in length. About 3300ft. of quayside is available for fitting out, and this part of the yard is well supplied with cranes, which include a 100-ton crane for lifting aboard heavy parts of machinery and boilers, and a large travelling tower crane.

Alongside the two largest building berths are two reinforced concrete gantries upon which four electric cranes with long revolving jibs are placed. The marking off and platers' shops—see page 466—which are roomy and well-lighted apartments with broad gangways for the transport of materials, are furnished with overhead electric cranes, so that the material passes quickly through the shops to the large area reserved for worked material outside these shops, which are alongside the building berths. This worked-material bay is in the open, but is well equipped with lifting appliances and furnished with pneumatic riveting machines for the assembly of frames and bulkheads, which, before finally passing to the ship, are completed as far as possible.

The total area of the shipyard is over 360,000 square metres, or nearly 90 acres, about one-sixth of which is covered by workshops. These include a foundry and smithy, along with shops for every class of shipbuilding work. There are also three floating docks, the largest of which has a lifting capacity of about 2500 tons.

A New Method of Shipbuilding.

The principal features of interest to the British shipbuilders who visited the Monfalcone yard was the specialised method of hull construction, which has been successfully introduced under the leadership of Signor Bori, and which is now being followed to some extent in all the Italian yards. By the courtesy of Mr. Augusto Cosulich, the managing director of the yard, we are now able to illustrate the method employed by the four photographs reproduced in to-day's Supplement. These views show different stages, each at about a month's interval, in the construction of the hull No. 205—the "Infanta Cristina"—of one of two motor passenger vessels, which have been built to the order of the Compania Trasmediterrania of Barcelona for service between that port and the Canary and Balearic Islands. They are ships of about 4500 gross tons, with an overall length of about 478ft. and a beam of 57ft. Each vessel is propelled by two 2600 S.H.P. eight-cylinder Burmeister and Wain airless injection engines, and the designed service speed of the ships is 16 knots.

The essential principle of Mr. Bori's method is the centralising of practically all the skilled work in the mould loft. In the illustration above we give a view in this loft, which is specially large, and has been designed to enable full-sized details of ships, up to a possible length of 1000ft., to be laid out. The technical staff of the mould loft is able by accurate geometrical expansion to give instructions to the markers-off, which allow the actual position of all holes to be determined and the size of the plates to be fixed. These particulars are then transferred to battens which give accurate particulars of the finished dimensions of the plate and the position of the rivet holes. The information given by the mould loft also enables the plates and angles to be bent to the required shapes, and the holes to be punched or drilled without referring any of the parts to the actual ship which is in course of construction on the stocks. The method is applied to the whole of the structural work of the ship, including the plates around the propeller bosses, some of which are illustrated on page 466, and to similar curved portions of the ship, and even the keel plates which join the castings at either end of the hull.

By the use of such a method it is possible to carry out the work in successive piecework operations, so that it automatically moves forward, starting as raw material, through the marking-off and punching shops to the assembling yard for worked plates, to which we have already referred. These subsequent operations we now propose to describe in a little more detail.

The plates are taken from the stock yard and enter the marking-off shops on the electro-magnetic lifting beams. Before marking-off, both sides of the plate are sprayed with a white solution by means of an air pistol. This solution drys immediately, and enables the required lines to be drawn on the plate

and the centres of the rivet holes to be "dabbed." For the purpose of locating the exact position of the hole to be drilled or punched, the markers-off employ a neat form of circular chiselled-edged punch, in the centre of which is a spring-controlled sliding centre pop. The point of the pop is placed in the centre previously marked, and a smart blow with the hammer marks on the plate a clear circle. The actual marking-off of these plates appeared to require no special skill, and it was being accomplished at a remarkably rapid rate.

The punching machines included a "Schiess-Lysholm" one-man punching machine for the largest and heaviest plates, and several double-ended and single-ended punches which have been equipped with automatic cables for one-man operation. Some of these machines are to be seen in the view reproduced below. At this stage of the work we noted that where a plate had to be duplicated for the other side of the ship, the two plates were bolted together, so that the completed plate formed a template for the other. As they are finished, both the plates and angles pass forward to the worked material department in which they are assembled before being put aboard the ship. In this department we noted that intercostals, longitudinal bulkheads, and other parts were being assembled by pneumatic riveting, so that they were ready to drop into position on the ship.

As our Supplement shows, after the vertical and horizontal keels have been laid down, the whole of the lower shell plates are built up and are supported on wooden shores. The top left-hand engraving clearly shows the shell plating with the vertical and horizontal keels and the intercostals in position. The top right-hand engraving, on the other hand, illustrates a later stage at which the assembled frames with the tank side knees are being put in and the tank top plating begun. Parts of the longitudinal divisional bulkheads are also to be seen. In the background of this engraving there is the worked-material yard, and to the left one of the lifting cranes. In the lower left-hand engraving the engine bearers are in position, and in the immediate foreground of the lower right-hand engraving a collision bulkhead and some of the deck beams will be seen.

It will be readily understood that as the hull is built up the structure is faired by the frames, bulkheads and deck beams, and is made ready for further riveting operations. In view of the doubts which have often been expressed as to the rivet holes, when assembled in such a way, being quite fair, a number of expert visitors were invited to inspect actual portions of the hulls seen under construction. They reported that in this respect the work was quite as good as could be found in our British yards. The progress photographs which we reproduce in to-day's Supplement are themselves evidence of the rapid rate of building made possible by the use of this specialised method of construction.

From the description we have given, it will be seen that most of the expert work is done in the mould loft, and that all the subsequent operations are such as can be carried out by a much less skilled *personnel*. It would appear that the economy in production thus attained is considerable, and we were given to understand that the labour on the steel structure complete, including riveting, caulking, and water testing, works out at fully 50 per cent. less in cost than in our own country. It must be borne in mind, however, that most of the steel materials were being obtained from outside Italy and that they entered the country free of import duty. In view of the notable reduction in the cost of materials and labour, we were not surprised to see that a large number of the recent orders were from foreign countries, including Spain, Portugal, Turkey, Argentina, and other South American States. At the present time when the question of another advance in the wages of steel workers in British shipyards is under consideration, might it not be advisable to reconsider some of our methods of ship construction. Certainly, the specialised system which is being so successfully employed at Monfalcone is one which deserves careful consideration on the part of British shipbuilders and shipyard workers, if we are to compete successfully for foreign orders.

MARKING-OFF AND PLATERS' SHOP

Electrical, Aeronautical, and Railway Workshops.

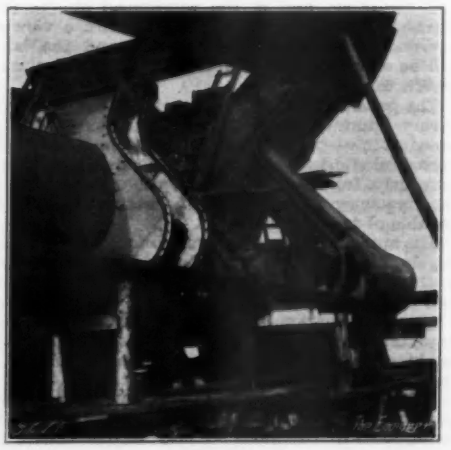
Below we reproduce an interior view of the electrical shops at Monfalcone, in which all the motor generator sets and other electrical apparatus for the ships under construction and for those which are being built at allied yards are made. There is also a department for the repair and upkeep of the yard electrical plant. In these shops we noted both direct-current and alternating-current machines of small and large size in progress, mass production methods, along with the Taylor and other organisation systems, being employed. In 1927 the electrical shops were enlarged so that the 900-kW and 450-kW generator sets for the motor liners "Saturnia" and "Vulcania" could be dealt with. The same works also supply land installations and general power station equipment, including transformers. The aeronautical department of the shipyard was started in 1923, with the revival of the Italian air services, and since that time various machines for the Portorose aircraft training school and for the Cosulich S.I.S.A. Line have been built. Over eighty seaplanes for military and commercial services have been supplied or are under construction, including some machines of the "Santa Maria Savoia" type. Both the wood and duralumin systems of flying boat construction are followed.

Adjoining the shipyard is the railway wagon repairing and building shops, in which about 1500 vehicles for the Italian State Railways are repaired and 300 built annually. The work is done in successive operations, so that the trucks are assembled in stages, and are slowly moved along the lines until they are completed. A similar system was seen in operation in the repairing of passenger carriages, and the plant has also been successfully adopted for the mass production of refrigerated wagons and closed trucks. The great reduction in the production costs which is obtained by the particular system of stage working employed is such that it is probable that wagons can be economically built for export purposes notwithstanding the competition of foreign firms and the Customs duties.

ELECTRICAL SHOPS AT MONFALCONE

Social Welfare Work.

The Public Utility Building Association, which was started by the Cantiére Navale Triestino at Monfalcone, has now built no less than 150 workmen's houses with 800 apartments, in which about 5000 persons are housed. There are also forty-five staff villas with 120 apartments, giving accommodation for 600 persons. The hotel for single shipyard workers has 800 rooms, while that for the staff has 120 rooms. Other amenities comprise two covered markets with about twenty-seven shops, including the firm's own grocery shops, at which foodstuffs are sold at specially low prices. These shops are also supplied with milk and vegetables from the farm sections of the Association. There are kindergarten schools, domestic economy, and typewriting classes, and libraries, also music and dramatic schools, and a theatre, in which performances are given and meetings and lectures held. Well-laid-out recreation and sports grounds, with excellent bathing facilities, are also available for the use of the shipyard workers, of whom more than 2000 are members of the Monfalcone Sporting Association. Throughout the whole of the shipyard and the other workshops there was evidence of careful thought and good organisation, which was equally apparent in the more social activities above referred to, which are undoubtedly an aid to the industrial prosperity of this many-sided engineering undertaking.



PLATING PROPELLER BOSSES

According to *The Times* work has begun on the exploration shaft in connection with the scheme for tunnelling the Straits of Gibraltar. The shaft is being sunk near Tarifa, and next month a corresponding shaft will be drilled on Spanish Protectorate territory in Morocco. Samples are being taken as the drill descends, and when the boring has reached a depth of several hundred feet below the level of the sea on the chosen line for the tunnel, charges of dynamite will be exploded. Special apparatus will register the sound of the explosion as it reaches the shaft on the other side of the Straits. By this means it is hoped to collect information as regards the nature of the soil beneath the sea.

Railway and Road Matters.

THE first stage of the aerial ropeway from Tilmanstone Colliery to Dover was opened on October 12th. The section brought into use goes as far as Pineham, and it is hoped to open the remainder before the end of the year.

THE failure of a wagon coupling on the Bedford-Bletchley section of the London, Midland and Scottish Railway on October 21st led to some wagons running back and meeting, head-on, a following goods train. The fireman of the latter was killed.

THE electrification of a part of the Northern Railway, Russia, from Mytishchi to Moscow, is well under way. The length of this line is only some 15 kiloms. It is already equipped with electric cables, and the last task at the present time is to equip the Moscow railroad yards.

WITH the end of the tenth month of the year it is interesting to note that for the first forty-two weeks the published traffic returns of the London and North-Eastern showed an increase in receipts of £950,000, whilst those of the Great Western had advanced by £473,000. The Southern, on the other hand, experienced a drop of £146,000, and the London, Midland and Scottish one of £560,000.

THERE has just been published, as a Stationery Office publication, price 1s. 9d., the report of the Harbours, Docks and Piers Sub-committee of the Rates Advisory Committee. It contains the conclusions of the Sub-committee as to why, as announced in August last, no change should be made in dock charges for the further twelve months from October 1st and why the railway companies' appeal for an increase should be declined.

THE Turkestan-Siberian Railway, the construction of which is, says the *British-Russian Gazette*, now nearing completion, is rather a striking example of the large measure of success attending many of the efforts of the Soviet Government to develop and reconstruct their country. This railroad, 1481 kiloms. long, connecting Semipalatinsk in Southern Siberia with the station Lugovaya on the Tashkent Railway and also with the station Aris, 160 kiloms. from Tashkent, passes over an area equal in extent to France, Germany and Italy combined. The territory coming within the economic radius of the railway includes a large part of the Kazakstan Republic, comprising 90,964,939 hectares, Northern Kirghiz with 11,934,650 hectares, and Southern Siberia with an area of 16,314,000 hectares.

IF Mr. Herbert Morrison, the Minister of Transport, has been correctly reported, he made an unfortunate remark when addressing the Railway Clerks' Association on October 25th. Remembering the office he holds, it seems rather unbecoming for him to say, according to the *Manchester Guardian*, that railways would either have to get on or get out. Mr. Morrison had been speaking of the proposals submitted by the companies for re-equipment with a view to improving the efficiency and, after a reference to the latest Departmental Committee on Electrification, he made the remark in question and concluded :—"He took the view that railways were an important part of the present transport system. He wanted them to be properly used, and the policy of the Government was that the companies should be encouraged to develop and improve their undertakings."

A VERY interesting possibility is created by the intended conversion from steam operation to electric traction of the former South-Eastern and Chatham Railway between Redhill and Guildford in that electrically operated trains run from Waterloo, Victoria and London Bridge *vid* Epsom to Dorking North, which is the station for Dorking on the Central or Brighton section. In 1926 the Southern Railway was given powers to lay in a curve between Dorking North and the Redhill-Guildford line which crosses the Epsom-Horsham line at that point. When that curve is provided it will be possible to provide a circular service, going by the main line to Brighton up to Redhill, thence over the Guildford line to Dorking, and back *vid* Epsom, with a corresponding service in the opposite direction. Again, as there is an electric service from Waterloo to Guildford, that can be continued over the proposed extension of electrification and back to London through Redhill.

A DEPUTATION from the East Suffolk County Council and other local authorities recently waited upon Mr. Lansbury and Sir Oswald Mosley to direct attention to the general transport facilities in their area. Three points were particularly urged : (1) The completion of the Mid-Suffolk Light Railway ; (2) the improvement of Southwold Harbour ; and (3) the closing down of the Southwold Railway. The unfortunate position of the last named will be remembered. It was a narrow-gauge light railway, and not therefore scheduled for absorption under the Railways Act, and the London and North-Eastern would not take it over voluntarily because of the expensive reconstruction that would be necessary. The Mid-Suffolk Light Railway is also in a bad financial way. It is open from Haughley to Laxfield, but there remains an extension thence to join the Ipswich–Yarmouth line at Halesworth, and a line from Westerfield, between Ipswich and Woodbridge, to join the existing Mid-Suffolk line at Kenton.

IN this column on August 23rd there was recorded the appointment of the various divisional assistants to Mr. A. F. Bound, the new signal and telegraph engineer of the London, Midland and Scottish Railway. Therein Mr. W. R. Jones was named as appointed to the Manchester division, but no intimation was made as to Mr. R. G. Berry, the then holder of that office. It now appears that it was intended that Mr. Berry should become Mr. Bound's assistant ; but, suffering, as he does, from lameness caused by rheumatism, he felt that he would prefer to take advantage of the changes and retire. That decision was accepted with regret, and Mr. Berry retired on October 31st. He has been connected with signalling for nearly forty years, the first nine of which were served under Mr. H. Raynar Wilson, the then signal engineer of the Lancashire and Yorkshire, to which office Mr. Berry himself went in 1911. By a coincidence he is this year's President of the Institution of Railway Signal Engineers, and his response to the toast of "The Institution" at its annual dinner on October 25th was, in a sense, a valedictory address.

Notes and Memoranda.

A PORTABLE equipment for producing over one million volts, for testing purposes, has been made by the Westinghouse Company of America. The voltage is provided by a set of fourteen units of five condensers, each of which is charged to 75,000 volts. The total weight of the apparatus is 10½ tons.

ON account of the reduction of the flow in the lower reaches of the Sacramento River, caused by the diversion of water for irrigation purposes, tidal salt water has advanced up the river, from San Francisco Bay, to twice its original extent during recent years. As a consequence, one of the local sugar companies has been forced to lay a pipe 16 miles long to bring fresh water, to the extent of 2½ million gallons daily, from inland wells.

A NOTE in the *Chemiker-Zeitung* states that gold finely deposited on a fibrous material has been found the most effective protective measure against mercury vapour dangers by the German electro-chemical industries. The usual process of preparing the material is to steep the textile support in a solution of gold salt and then to reduce this latter by chemical means to the colloidal metallic state. The gold layer can also be applied to the textile by the metal spraying processes which are now acquiring such importance industrially.

AN article in the *Chemical Trade Journal* states that one of the best known plants for making hydrogen, on a large scale, by the watergas process, is the Lane-Rogers plant at the Fuel Research Board Station, which is being experimented with. It is suggested that if, as the result of this work, the efficiency of the iron-steam method is considerably increased, the method will present many advantages to seekers of hydrogen supplies and the Fuel Research Board will have performed not the least of its services to the chemical industry.

AT a recent meeting, the Council of Management of the British Science Guild, expressed by resolution disappointment that "the Royal Commission on the Civil Service recently set up by His Majesty's Government does not include among the members a single man of science or one engaged in the application of science to the needs of the community. The Council records its emphatic protest at the omission to appoint upon the Royal Commission a due proportion of members familiar with national aspects of pure and applied science, particularly in view of the fact that an urgent necessity exists at the present time for a complete and impartial review of the status and functions of the considerable body of scientific and technical experts forming part of the Civil Service."

A THERMOMETER so delicate that it can measure the heat from stars is a recent application of electricity to scientific research. Stars invisible to the naked eye are found in a powerful telescope, which concentrates the starlight over the measuring device. The rays are carried through a small window into an exhausted receiver and fall upon a thermo-couple. This consists of a junction of two tiny wires of different metals, which, if heated, sets flowing a minute electric current through a sensitive galvanometer. The wires of the thermo-couple are one one-thousandth of an inch in diameter, and the whole unit weighs less than one six-hundredth of a grain. The heat from Betelguese, which emits more than any other star, raises the temperature of the thermo-couple by about one-sixtieth of 1 deg., but so sensitive is the galvanometer that the infinitesimal current set up causes the recording spot of light to swing through 18in. More than 100 stars have been measured, and experiments thus far indicate that the apparent brightness of a star may have little or nothing to do with its heat, since much of the heat may be radiated in waves invisible as light.

SPARKING at the brushes of direct-current electrical machinery, states the *Electrical Review*, is often aggravated by the heating of the brushes and commutator. In many cases machines will run sparklessly until thoroughly heated up, when severe sparking may start. This is due to the alteration in the contact resistance at the brushes, which falls as the temperature rises. Up to temperatures of 95 deg. Fah. there is no great change in the contact resistance, but when this temperature is passed there is a rapid fall. At temperatures between 135 deg. and 167 deg. Fah. the contact resistance at the positive brushes will be only 80 to 50 per cent. of the resistance at 95 deg. Fah., while at the negative brushes the corresponding resistance will only be some 25 to 10 per cent. By negative brush is meant the brush at which the current flows from the brush to the commutator. The alteration in the contact resistance causes increased sparking, more especially as the contact resistance at the positive and negative brushes does not alter in like proportion. This shows the importance of keeping the commutator and brush gear cool, if necessary employing artificial means to do so.

JAPANESE waltzing mice have been found to be more responsive to concentrations of the deadly carbon monoxide than canaries, long used by the United States Bureau of Mines, Department of Commerce, for this purpose in connection with mine rescue operations. On the other hand, guinea pigs have been found to be unsuited for detecting dangerous amounts of carbon monoxide. The use of small animals, as canaries and mice, for exploring and detecting atmospheres contaminated with carbon monoxide, depends on the fact that, owing to their high metabolic rate and oxygen demand accompanied by high respiratory exchange and rate of circulation, they respond more quickly than man to a given concentration of gas. From a practical viewpoint this allows a margin of time between observable serious effects to the animal and serious effects to man, during which period man can return to fresh air or employ means of respiratory protection. It should be remembered, however, that during the time the animal is incurring a detectable degree of poisoning, man is also absorbing some carbon monoxide, and in some cases may attain a very discomforting degree of poisoning, especially if the particular animal is more tolerant than the average. The margin of time between effects in the animals and in men is not very wide, and experience with canaries has shown that an occasional specimen may be tolerant enough to fail to exhibit symptoms before serious effects are incurred in men.

Miscellanea.

THE Southend Corporation proposes to expend £68,000 on electricity plant.

A COKE oven plant of the Coppée type is to be installed at the new Ford Works, Dagenham, Essex.

IT is proposed to construct an aerodrome on a piece of land about two miles square, within nine miles of Port Elizabeth, South Africa.

THE air mail services of Canada are to be extended as far North as Aklavik at the mouth of the Mackenzie River. The distance from McMurray is 2000 miles.

IT is proposed to convey brine from Northwich to the Widnes works of Imperial Chemical Industries, Ltd., but the Northwich Council is opposing the scheme.

TWO turbo-alternators each of 33,000 kilowatts capacity are being made for the Northern Provinces Electricity Company, of Holland, by C. A. Parsons and Co., Ltd., of Newcastle-on-Tyne.

THE deposits of diatomaceous earth in the valley of Kentmore, in the Lake District, are now being actively developed. The material is being used principally for the manufacture of insulating bricks.

AN important step in the improvement of Colombo's (Ceylon) telephone system is to be carried out during the next financial year, when the automatic telephone system is to be extended to all private subscribers.

IT is claimed that the 20,000 kilowatt turbo-alternator which is being supplied to the Calcutta Electric Supply Corporation by C. A. Parsons and Co., Ltd., of Newcastle-on-Tyne, will be the largest unit of its kind in India.

THE first plant for the experimental commercial production of beryllium in Germany will be inaugurated in November at the Wernerwerk of Siemens and Halske, of Berlin. The plant will have a monthly capacity of approximately 100 kilos.

IT is said that the exploratory work already carried out in Sierra Leone has disclosed the existence of from 10 to 15 million tons of high-grade hematite iron ore in the Marampa Hills, and it is expected that this estimate will be exceeded as prospecting progresses.

THE electric stock which is to be supplied to the Madras Suburban Railway Services by the English Electric Company, comprises seventeen three-coach units, each consisting of three all-steel coaches with the necessary electrical equipment, and four electric goods locomotives.

TWO new dredgers are required for service on the coast of South Africa. One, to replace the Nautilus, is to be stationed at Durban, the other, of the grab type, will be a sea-going twin-screw vessel with a hopper capacity of 700 tons, and capable of a speed of 10 knots when fully loaded, and of dredging to a depth of 65ft.

RECENT surveys of the oil discovered near the City of Perm, Russia, have proved this deposit to be of commercial value. The thickness of the oil-bearing beds is estimated at not less than 50 m. This oil occurs in porous limestones similar to the Bradford formations in the United States. The analysis of the oil shows that although in some respects it is inferior to that found in the Baku and Grosny oilfields, yet it is of high quality.

ACCORDING to a report of the United States Shipping Board on the performance of the ss. "West Alsek," which is fitted with the Todd system of burning pulverised coal, the equipment has produced :—(1) An increase of 9 per cent. in the average speed of the vessel ; (2) the attainment of this speed on coals costing on an average about 4s. 1d. per ton less than run-of-mine American coal ; (3) a saving in cost per fuel mile of 38·9 per cent., compared with coal for a like amount of work ; and (4) a saving of 20 per cent. in stoke-hole crew.

THE annual Artist-Craftsman Exhibition, which is being held this year at the Central Hall, Westminster, from Saturday, October 26th, to Wednesday, November 6th, inclusive (from 11 a.m. to 7 p.m.), consists of a representative display by a score of trained modern craftsmen practising the traditional crafts, including pottery, hand-made jewellery, iron and leather work, printing, illumination, weaving and other crafts. The exhibit by rural smiths and saddlers is a step towards the development of these crafts in other directions than in those merely auxiliary to the motor garage.

THE new Heavy Motor Car (Amendment) Order, dated October 11th, 1929, deals with the use and construction of articulated vehicles. The expression "articulated vehicle" is defined in the Order to mean a heavy motor car together with a trailer drawn thereby which is so constructed and by partial super-imposition attached to the heavy motor car that a substantial part of the weight of the trailer is at all times borne by the heavy motor car. The Order specifies that every wheel of such vehicles shall be fitted with resilient tires, and that where the tires are not pneumatic the rim diameters of wheels so shod shall be not less than 670 mm. The total overall length of such vehicles, excluding any starting handle, is limited to 33ft. The limits of weight to be borne by the wheels of such vehicles, and how such weights may be distributed, are also prescribed. The Order comes into force on January 1st next.

THERE is, says the *South African Engineer*, every likelihood that the seat of the Administration of Northern Rhodesia will be moved away from Livingstone to some point further north, and it is apparently felt that some other *raison d'être* must be found for the town, and in view of the currency given to the idea that electric power attracts industries, public opinion favours the harnessing of the Victoria Falls. It is not at all clear who will undertake such work or on what economic basis it could be placed. At all events a scheme for drawing off sufficient water for 2000 kW and for an initial installation of 1000 kW of plant is being reported upon by Mr. A. E. Val Davies. This development, it appears, can be accomplished without obstruction to a later and more comprehensive one. It remains to be seen if, on presentation of the report, anyone can be found to shoulder the financial responsibility of proceeding with the undertaking.

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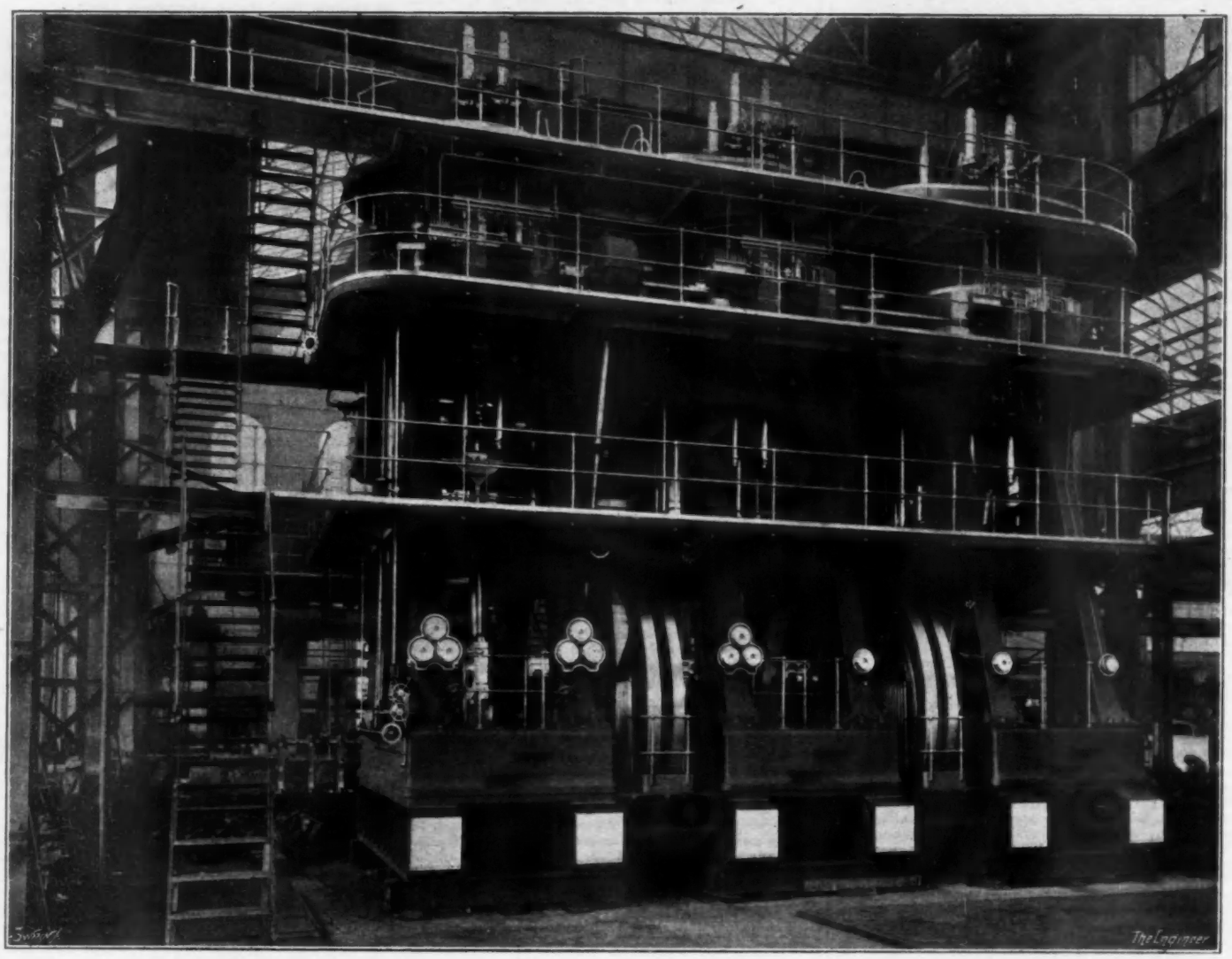

FIG. 12—1300 H.P. TRIPLE-EXPANSION STEAM ENGINE

FIG. 13—SINGLE-ACTING, THREE-RAM, HIGH-LIFT PUMP

The Engineer

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DEATH.

ON October 25th, FRANK POCHIN, managing director and one of the founders of Goodwin, Barsby and Co., Ltd., Leicester.

THE ENGINEER.

NOVEMBER 1, 1929.

British Power Station Performances in 1928.

THE steady improvement which is taking place in the conditions of power production in Great Britain is once more exemplified in the latest Annual Returns of the Electricity Commissioners. Obsolete stations are being shut down and replaced by fewer and more efficient stations, the output of electricity is increasing, and the fuel consumption per unit is going down. There are now 564 stations included in the Returns, and during the year ending on March 31st last, they generated 10,878,980,925 kilowatt-hours for an aggregate consumption of 9,562,109 tons of coal, coke, and oil. Compared with the preceding year, these figures show an increase in output of 9·58 per cent. for an increase in fuel consumption of 3·66 per cent. only. Of the total production, ordinary steam stations account, of course, for by far the greatest proportion, though the percentage has fallen from 95·7 to 95·39 during the year. Waste-heat stations, on the other hand, have contributed 2·20 per cent., as against 2·19 per cent.; water power stations, 1·37 per cent., as against 1·05 per cent.; and oil engine stations, 0·68 per cent., as against 0·63 per cent. The outputs of both gas producer and refuse destructor plants have both dropped relatively as well as absolutely. It is satisfactory to note that the average economy of steam stations, oil engine stations, and gas producer stations has in all cases been again improved, the steam stations now generating a kilowatt-hour for 2·05 lb. of fuel taken as an average over the 332 steam plants with which the Returns deal. The progress which has been made in recent years will be realised when it is remembered that before the war only the best-managed and best-equipped plants could show a figure of less than 3 lb. per kilowatt-hour. There are, indeed, even now no less than 106 steam stations, or nearly one-third of the total, which return coal consumptions of 3 lb. per kilowatt-hour or over, so that there is still a good deal of room for improvement, though it must not by any means be taken for granted that the elimination of these stations, small for the most part, and the replacement of their services by long-distance transmission from the larger centres would result in any cheapening of electricity to their consumers.

More than half the total public power supply of the country is now generated in thirty-three power stations, out of the 564 in operation, and more than one-quarter in ten stations only. Barking has the largest individual output, namely 400·5 millions of kWh, being followed by Barton with 359·6 millions, and five more plants with upwards of 250 million kWh each. Both Barking and Barton have succeeded in improving on their thermal efficiencies as given in the previous returns, the former being credited now with 20·61 per cent., and the latter with 21·31 per cent. Last year Barton held the record for thermal efficiency among all the power stations of Great Britain, with a figure of 21·07 per cent., but this year, in spite of making good progress, it has to yield pride of place to the Padiham station of the Lancashire Electric Power Company. This wonderful little station, with an output of only 67 million kilowatt-hours on a load factor of 42·5 per cent., now holds the double palm among British stations for a thermal efficiency of 21·35 per cent., and a coal consumption of no more than 1·33 lb. per unit generated. Its nearest competitor in thermal efficiency is Barton, with an output of 359·6 million kWh, while in coal consumption its runner-up is North Tees, which reaches 1·35 lb. per unit on an output of 261·1 millions. That a small station like Padiham can beat such comparatively Goliath plants as Barking and Barton, not to mention Lots-road, Prince's station at Birmingham, Dalmarnock, Carville, and North Tees, all with outputs of over 250 millions, and beat many of them by a very handsome margin, is a convincing tribute to the excellence of its design and management. It certainly has the advantage of youth, and it might be considered unfair to make comparisons with a station like Carville, now some sixteen years old, were it not that the working pressure of 250 lb. is no higher than that at Carville, while the steam temperature of 620 deg. Fah. is even lower. For a station with such extremely moderate steam conditions to take the lead of every other public power station in Great Britain as regards efficiency, regardless of size, load factor or anything else, is almost as extraordinary as it is creditable. We noted the results given by the Commissioners with particular satisfaction, as they confirmed figures given by ourselves in the full account of the Padiham plant and the methods of its operation published in our issues of July 20th and 27th last year. There are no steam stations other than Padiham, Barton, North Tees, Ferry Bridge, Barking, and Hartshead for which a thermal efficiency of over 20 per cent. is given. The latter plant, which belongs to the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, put up a very good performance, showing a thermal efficiency of 20·53 per cent., and a coal consumption of 1·58 lb. per unit on an output of just about 32 million kilowatt-hours. Hartshead, indeed, holds the records for both thermal efficiency and fuel consumption among the forty-nine stations of its class, with outputs ranging from 25 to 50 millions. Padiham, being in the next class, which ranges from 50 to 100 millions, prevents any of the other thirty-one stations in this group from receiving special mention on the score of economy. In the next group above, comprising fourteen stations with outputs between 100 and 200 millions, the place of honour is held by Lister Drive at Liverpool, another plant of which we gave a full description in our issue of October 19th and the three succeeding weeks last year. At Lister Drive the thermal efficiency is 19·77 per cent. and the coal consumption 1·48 lb. per kilowatt-hour. Finally, in the group of eleven stations with outputs of over 200 million kilowatt-hours, North Tees holds the fuel consumption record with 1·35 lb., and Barton the thermal efficiency record with 21·31 per cent.

The competition between power stations as regards efficiency is now so close that we take this opportunity to urge upon the Commissioners a very necessary reform in the way the figures are computed. At present the output of each plant is taken as the gross number of units generated by the main machines, and the fuel consumptions and efficiencies are calculated on this basis. The engineer can consume as many of these units as he likes in driving fans, circulating pumps, boiler feed pumps, stokers, coal pulverisers, elevators, conveyors, and all the multitudinous auxiliary apparatus of a modern power station without making any difference to the thermal efficiency as officially registered. This is obviously unfair as between stations with different consumptions of auxiliary power, and also unfair as between stations with a greater or less proportion of electrically driven auxiliaries. The point is by no means a

trifling one. Indeed, a short time ago a central station engineer, desirous of improving the somewhat poor efficiency of his plant, was advised by another that by merely converting his steam-driven auxiliaries to electric drive he could put up his efficiency, before the world, by something in the order of 6 per cent. Logically, also, the present method of computation is indefensible, for electric power used in the station itself cannot truly be regarded as output. The proper basis of reckoning should be the power which actually leaves the station by the out-going feeders, for this is all that the station produces from a commercial point of view. Even so, there still remains the fact that some stations would be free from the transformation and conversion losses imposed on others by the nature of their demand for power, but the slight unfairness attributable to such differences would be negligible in comparison with the unfairness which exists at present. Every station must know quite well what its actual net output of power delivered to the feeders amounts to, so that the use of this figure in place of the aggregate readings of the machine wattmeters would cause no difficulty whatever. A reformation of the present practice has, we believe, been demanded for some time, and we trust that when the next Annual Returns are published the figures, both for outputs and efficiencies, will be given on the basis of net commercial production. The change may, and indeed probably will, alter the relative position of many plants between which the competition for efficiency is closest, but it will have the effect of giving credit where it is really due and so enhancing the confidence with which the Returns are accepted. Furthermore, it will be in the interests of good design, for it will discourage the lavish expenditure—one might really say waste—of auxiliary power in the station itself, with the object of obtaining a meretricious figure of efficiency. We think it right to make clear that Padiham does not hold its unique position as the most efficient of all British stations by any undue use of auxiliary power. Of the gross power output, only 3·06 per cent. was consumed in the station, as an average over six winter months, as will be seen from the description of the plant which we published last year. This proportion is so low in comparison with that of many of the modern elaborate power stations, that were thermal efficiency and coal consumption computed on the basis of net output, it is more than likely that the lead of Padiham over all its competitors would be even more marked than appears from the present form of the Returns.

The Mediterranean Navies.

THE tentative naval understanding between Great Britain and the United States has led to the issue by the former of invitations to a Five-Power Naval Conference, to be held in London towards the end of January. These invitations have been accepted in polite, even cordial, language by all the Governments to which they were addressed. From present indications it seems probable that Great Britain and the United States will bring to the Conference almost parallel proposals, their major differences having been adjusted in the course of the preliminary conversations which began in London some months ago and were continued during the Prime Minister's visit to Washington. So far as the public is aware, the two countries are now in complete agreement on all points save one—the number of 10,000-ton, 8in. gun, cruisers to be retained by each. As it is only a matter of two or three ships either way, the reaching of some compromise appears to be a foregone conclusion. It is understood that both Governments will advocate the prolongation of the life of capital ships, and, consequently, the postponement of the battleship replacement scheme embodied in the original Washington Treaty. If this plan is adopted, and no opposition is expected from any quarter, the construction of new capital ships will be deferred until 1936. Furthermore, both Governments are said to have agreed on a common tonnage aggregate for destroyers and submarines. They would prefer the abolition of submarines *in toto*, and will join in advocating this measure, though they recognise the serious difficulties that stand in the way. Japan is believed to be in sympathy with the substance of the Anglo-American proposals, but considers herself entitled to a higher ratio in "auxiliary craft" than was accorded to her in battleship tonnage under the Washington covenant. Instead of a three-fifths proportion as compared with the British and American total, she desires, and will probably demand, seven-tenths. This, again, is not a very serious difference, though it would be imprudent to attempt to forecast the reception which the Japanese claim will meet with in London and Washington.

As the three leading maritime Powers apparently find themselves in agreement, in principle at least, on most or all of the fundamental questions relating to naval disarmament, it seems clear that the outcome of the London Conference will depend in large measure on France and Italy. If there is in the world at present anything in the nature of a naval shipbuilding race, it lies between these two Powers. France has now, and has had for several years past, a larger amount of naval tonnage under construction than any other country. Italy, although building fewer ships than her neighbour, has a considerable number on the stocks, and no attempt is made either in Paris or Rome to deny the patent fact that there is a very direct relationship between the two programmes. There is no reason whatever to suppose that either France or Italy is hostile to naval limitation. Each State, however, is concerned for its future security and naturally suspicious of any movement calculated to weaken its national defences. Since the war, French naval policy, previously vague and erratic, has crystallised into definite principles which are being pursued with admirable directness and perseverance. France is resolved to create a fleet which shall be strong enough to guarantee the integrity of her communications with North Africa, which has become indispensable as a reservoir of man-power and raw materials, and at the same time to neutralise any expansion of the German Fleet. Such, at any rate, are the two objects proclaimed by every French naval commentator of whom we have knowledge. France, in other words, has adopted a two-Power policy. To ensure the safety of her Mediterranean routes she must have, at the very least, local equality with Italy, while the defence of the Channel and of her long Atlantic seaboard would demand a considerable force above and beyond what was required for the Mediterranean. This policy may seem simple and logical, but unfortunately the position is complicated by Italy's claim to naval equality with France. Should that claim be persisted in, as every recent pronouncement from Rome suggests it will be, France will undoubtedly hesitate to restrict her future naval construction to anything less than generous limits, which may be difficult to reconcile with the Anglo-American plan of reduction on a drastic scale. The political aspects of the situation concern us less than the material evidences of current naval expansion in the Mediterranean. In no other sphere is there so much building activity. Hampered as they are by limited funds, both the French and Italian naval authorities seem determined to extract the utmost value from every franc or lira spent on naval defence. Save in one respect, they have ignored the ship standards established by the Washington Treaty, the exception being the 10,000-ton cruiser. To date each Power has laid down six vessels of this class, but it is unlikely that more will be built. Besides being very expensive—£2,600,000 is, we believe, the average cost of such vessels built in French and Italian shipyards—they are not well adapted to the conditions of Mediterranean strategy. Italy has broken away from the Washington tradition by laying down six cruisers of 5300 tons, and it is semi-officially hinted in Paris that the next group of French cruisers will not exceed 7000 tons. Naval architects and engineers await with interest the disclosure of particulars of the new Italian ships. On the displacement mentioned they are to have turbine machinery of nearly 100,000 S.H.P. for a speed of 37 knots, and an armament of eight 6in. guns paired on the centre line. Their radius of action is bound to be limited, and it is a reasonable assumption that they have been designed with more than a casual eye to the remarkable flotilla leaders or scouts which France is building. This type is reminiscent of the French "torpedo-gunboats" of the 'nineties, which caused some alarm in this country and materially influenced our own designs. The six boats of the 1928 programme may be taken as typical of the class. They displace 2700 tons—3200 tons at full load—are 430ft. in length, and have turbine machinery for a speed of 38 knots. They will be armed with five or six 5·5in. guns and six or eight torpedo tubes. On paper such vessels are little inferior in fighting value to light cruisers, albeit unsteadier gun platforms, and they have become a favourite type with the French Navy. Eighteen have been built or ordered up to the present, in addition to twenty-six heavy destroyers, all armed with 5·1in. guns. Of other recent French types, the aircraft tender "Commandant Teste," of 11,000 tons, and the cruiser-minelayer "Pluton," of 5300 tons, 30 knots speed, and an armament of four 5·5in. guns, merit attention. Of the ninety-one submarines comprised in the French programme, fifty-five are ocean-going and thirty-six coastal boats. In marked contrast with former practice, the new French Navy is being built up in homogeneous ship groups. As with cruisers and torpedo craft, submarine design has been virtually standardised. The nine large boats, "Requin" class, of the first group are uniform in all respects, and from experience with them an improved type, "Redoutable," was evolved, of which no fewer than twenty-five units have been built or ordered up to now. It is hardly necessary to point out the many advantages which accrue from this standardisation of types, not the least being economy in construction and upkeep and tactical efficiency. Whatever the shortcomings of pre-war French submarines may have been, there can be no doubt as to the all-round excellence of the post-war boats. It is a standing rule that each submarine, as soon as possible after commissioning, shall proceed on a "shake down" ocean cruise of several thousand miles, unaccompanied. Exercises of every kind are carried out *en route*, including full-power runs and prolonged submergence trials. This regulation has been in force for five years, and it is a wonderful testimonial to the design and workmanship of the boats that during all this time not a single submarine has broken down or met with any mishap attributable to mechanical defects. Let there be no mistake about it—the modern French submarine flotilla is an extraordinarily efficient and formidable fighting force. The entire French building programme, covering the period 1920–1942, embraces 223 ships. There are eighteen cruisers, ninety flotilla leaders and destroyers, sixty-seven ocean-going, and forty-eight coastal submarines. Approximately, half these vessels are already completed or on the stocks, and the systematic way in which the first part of the programme has been carried out suggests that the second half will be completed according to schedule—provided, of course, that the development of French naval power is not arrested by a new international covenant.

Thanks to her impressive total of new construction, France will occupy a very strong position at the London Conference. Although Italy for the past eight years has claimed the right to naval co-equality with France, she has only recently exhibited signs of putting the claim into effect. Since the war she has built and authorised eighty-eight vessels, viz., six cruisers of 10,000 tons and six of 5300 tons, forty-six destroyers, and thirty submarines. A new, long-term building programme is foreshadowed in Rome, but is not likely to be introduced until the outlook has been clarified by the result of the London Conference. The main point of interest is that the new negotiations for the reduction of navies have come at a time when France and Italy are deeply involved in programmes of naval expansion, and when, moreover, both are possessed of a strong and growing belief in the importance of sea power. That is why, as we observed above, the issue of the London Conference seems likely to be determined in the main by the attitude of the two Latin Powers.

The Fuel Research Board.

THE Annual Report of the Fuel Research Board was published on October 24th. Below we reprint Sir Richard Threlfall's letter to the Privy Council, in which the work of the year is summarised:—

The problems involved in the study of our coal resources, and how best to utilise them, are so many and complicated that it is difficult for one research organisation of any reasonable size to deal adequately with them all. It is gratifying, therefore, to note the increasing attention being given to fuel research, both by individual firms and by industrial organisations.

During the year the Gas Light and Coke Company opened new research laboratories at their Fulham gasworks, and the equipment includes experimental settings of full-size horizontal and vertical retorts with special condensers, washers, purifiers, &c., as well as the usual laboratory apparatus. The Chairman of the Fuel Research Board was invited to visit the works and to open the laboratories, which he did on July 26th, 1928. Imperial Chemical Industries, Ltd., and other firms are also spending large sums on those aspects of fuel research of more special interest to their activities.

The National Federation of Iron and Steel Manufacturers has formed an Industrial Research Council, which will receive financial assistance from the Department, in the same way as research associations. This new organisation will develop the work already being carried out by Coke Research Committees on metallurgical coke, and other work of equal importance to the industry. The close connection that has in the past subsisted between the Fuel Economy Committee of the Federation and the

Director of Fuel Research will be maintained under the new organisation.

The increasing general and world-wide interest in fuel research is indicated by the number of conferences dealing with the subject that have been held during the year. A Fuel Conference was held in London from September 24th to October 6th, 1928, as a sectional meeting of the World Power Conference. This meeting was attended by leading fuel technologists from all parts of the world, and the papers presented and discussed give a survey of the latest developments. The Second Congress of Industrial Heating was held in Paris in June, 1928. The Second International Conference on Bituminous Coal was held at Pittsburg, Pa., U.S.A., in December, 1928. The proceedings of all these conferences emphasise the fact that the practical problems of fuel utilisation differ greatly in the different countries.

The Director of Fuel Research attended the Pittsburg Conference, and was able during his visit to America to obtain first-hand information as to the latest developments in that continent, more especially as regards the use of pulverised fuel.

The National Fuel and Power Committee, which was appointed in 1926 by the President of the Board of Trade "to consider and advise upon questions connected with the economic use of fuels and their conversion into various forms of energy," has issued two reports during the year. In the first of these, they emphasise the importance of research, and particularly the necessity for the application of the results of research and the consequent necessity for employment, on the executive side of industry, of more men trained as fuel technologists. They emphasise, as we have done on more than one occasion, the importance of colliery owners grading the coals they produce, and selling them under some sort of specification. As the result of one of the recommendations in this report, the President of the Board of Trade has appointed a Committee "to undertake an investigation as recommended by the National Fuel and Power Committee in its report of September, 1928, in relation to a limited area, such as that between the Humber and Liverpool and between Leeds and Birmingham, respecting the technical and economic aspects of an area gas supply system, comprising an interconnecting network of pipe lines fed by a number of gasworks, coke ovens and the like." The Director of Fuel Research has been appointed a member of this Committee.

The second report of the National Fuel and Power Committee dealt with a specific reference on proposals to extend and amend the existing legislation relating to gas. The thermal system of charging for gas, introduced by the Gas Regulation Act of 1920 on the recommendation of the Fuel Research Board, was considered, and the Committee expressed the opinion that this system is a fair one and affords the best possible protection for consumers. They recommended that the system should now be made compulsory, except for very small undertakings This recommendation has been embodied in the Gas Undertakings Act, 1929.

Details of the work carried out during the past year under the supervision of the Board are given in the report of the Director of Fuel Research, which is issued herewith, and, as usual, we only propose in this report to deal briefly with the various aspects of the work.

The Physical and Chemical Survey of the National Coal Resources has progressed steadily. A Committee was appointed in June, 1928, to deal with the South Wales area. There have been some difficulties in finding suitable accommodation for the local laboratories, but these have now been overcome and work should start in the near future. With the appointment of this Committee the organisation covers coalfields producing 85 per cent. of the coal raised in Great Britain. The object of the survey is to ascertain, in detail, the properties of the various coal seams, so as to determine the purposes for which each is suited, and the best methods of cleaning, grading, and blending the seams or portions of seams for the various purposes for which the coal may be required in each case. The detailed investigation of the seams, and of the variations that occur both throughout the thickness of a seam, and from point to point in the coalfield, is necessarily a lengthy process. The investigation is one in which the value of the results is cumulative, and the full value cannot be obtained until a number of seams have been examined; nevertheless a number of incidental observations have been made which are of considerable and immediate value. Some of these are mentioned in the Director's report. A study of the correlation of the seams throughout each coalfield is an important section of the work. Much of the existing information on this subject is scattered in general geological publications, issued by the Geological Survey and others.

If coal is to be used to the best advantage, it is necessary to know what properties are desirable in the coal to be used for any particular process, and how variations in the coal affect the working of the process, and it is very desirable to be able to test these properties on laboratory samples. One of the objects of much of the work is the development of methods of determining the various properties, and the correlation of the laboratory results with full-scale working. A number of methods which have been examined or developed at the Fuel Research Station or in the local Survey laboratories are described in Section III. of the Director's report.

The same considerations apply to the use of coke and the examination of methods of testing coke in the laboratory. The correlation of the test results with, on the one hand, the coal from which the coke has been made and the conditions in which it has been carbonised, and with, on the other hand, the suitability of the coke for use in various industrial processes, has formed a large part of the work of the Coke Research Committees, formed at the instigation of the National Federation of Iron and Steel Manufacturers and working in conjunction with the Fuel Research Station and the Survey Laboratories.

Large-scale investigations on the carbonisation of coal in gas retorts have continued at the Fuel Research Station. A lengthy investigation into the effect of the size of the coal charged to the retorts, on the nature of the products, has been concluded, both vertical and horizontal retorts having been used for this purpose.

It is now nearly ten years since the vertical gas retorts were erected, and this setting is approaching the end of its useful life for experimental purposes. The retorts were originally erected for the purpose of assisting the gas industry to utilise the greater freedom as to methods of manufacture of gas which resulted from the adoption of the thermal system of charging and the abolition of a compulsory illuminating standard of quality, and, in particular, to provide reliable data as to the effect of steaming the charge during the carbonising period. This work has been completed, and a number of other investigations has also been carried out, the results of which have been widely adopted by the industry.

There is still much to be done on the horizontal retort setting before the programme of work for which it was erected can be completed. These retorts were cooled down for examination and repair during the summer of 1928, and the excellent condition of the combustion chambers was the subject of remark by various experienced gasworks and coke oven engineers who saw them. This is attributed to the methods adopted at the station for the close control of the heating of the retorts as is described in the Director's report.

The provision of a second water gas plant at the Station has made it possible to carry on more extensive work on the details of this process, and the investigation will be given a higher priority in the programme of the Station than has been possible in the past. Although the manufacture of water gas, both by gas undertakings and others, has been widely carried out on a commercial basis, there are still a number of points on which further information is required. The constants involved in the reaction between steam and carbon, oxygen and carbon, carbon dioxide and carbon, and the effects of temperature, of inorganic impurities, and of the physical state of the carbon, are but incompletely known, and are of fundamental importance, not only for the production of water gas, but for nearly every process by which coal or coke are utilised.

The development of low-temperature carbonisation of coal has now reached a definite stage. A number of commercial plants, on several different systems, have been, or are being, erected, and the processes will now stand or fall according to the financial results obtained in actual working. Among the plants now working is that erected by the Gas Light and Coke Company at the Richmond (Surrey) gasworks, to the general design developed at the Fuel Research Station. Companies with a total nominal capital of some £5,500,000 have been formed to develop some twenty-six different processes. Some of these are now working and others should be producing in the near future. It is unlikely that all will prove successful, and some have unfortunately been launched without that careful trial of full-size unit plant which is so essential.

The investigations carried out at the Fuel Research Station since its erection have shown the type of products that can be expected from the low-temperature carbonisation of a variety of different coals, and have furnished data of value for the development of any type of low-temperature carbonisation process. The tests which the Director of Fuel Research has been authorised to carry out on plants developed and erected elsewhere have shown the actual technical results obtained from them, and thus materially assisted in their development; or have indicated the conditions under which each type of plant is likely to have the best chance of successful working. We wish to emphasise once again that the prospects of success of any process must depend very largely on the local conditions under which it is worked, particularly the margin between the cost of the coal used and the price obtainable for the coke produced, as well as the market available for the gas and other products. It must be remembered that different processes require different local conditions for success, and that the market prices of both raw materials and products in any locality may be appreciably affected by the development of a process of low-temperature carbonisation in that locality.

The question of the commercial development of low-temperature carbonisation is of such importance that we wish to draw special attention to the remarks on page 37 of the report of the Director of Fuel Research, which summarise the considerations that must be borne in mind when attempting to assess the prospects of any particular process in any particular environment.

Two new low-temperature retorts are being installed at the Fuel Research Station to a slightly modified design, which it is thought may be an improvement on the patterns previously in use there, particularly as regards their life. They will be kept in use to determine their behaviour and life, to test various coals, and to provide material for further investigations on the products.

Although low-temperature carbonisation plant has now reached a stage of development where a lower priority can be given to its study at the Fuel Research Station, there is still much to be done in the study of the tars produced, and the best method of their utilisation. This will be continued both at the Fuel Research Station and at the Chemical Research Laboratory of the Department.

As has already been mentioned, the study of metallurgical coke in particular, has been continued. Professor Bone, Professor Cobb, Dr. Illingworth, Mr. C. N. Kemp, Dr. Lessing, Mr. McCulloch, Mr. Seyler, and Professor Wheeler, are being assisted in carrying out work on the constitution of coal, or on its coking properties. These investigations, as well as the large-scale work on gasworks retorts and low-temperature carbonisation, all contribute to a better understanding of the phenomena involved in coke production.

The question of whether special large-scale experimental work on the production of coke in coke ovens is required, and, if so, how it can be carried out most economically, is at present under consideration.

The experimental washery at the Fuel Research Station has been used for a number of experiments, partly to study the behaviour of the different types of coal cleaning appliances, partly to devise laboratory methods of checking and controlling the results, partly to see how individual coals can best be treated, and partly to provide specially clean coal for hydrogenation and other experiments.

The study of the factors involved in the hydrogenation of coal has continued, both on a small scale and in the intermediate scale plant. The reactions that occur during the treatment of coal with hydrogen under pressure are far from simple, and their study is a lengthy process, but it should eventually throw considerable light, both on the constitution of coal and the mechanism of coking. Incidental to this work has been the study of the plant used for the production of hydrogen, and the details of the reactions involved.

The chemical examination of pitch has been in abeyance pending further information being obtained on the practical requirements of the briquetting process. The briquetting plant has been studied, and adapted so as to have all the relevant factors under control and measurable. It is impossible to correlate the chemical and physical properties of pitch, as determined in the laboratory, with its behaviour as a binding material for briquette making, until the influence of other factors, such as the temperature and moisture of the paste, and the pressure applied, can be ascertained.

Dr. Margaret Fishenden has continued to supervise work on domestic heating, which is being carried out at the Fuel Research Station from the point of view of the combustion of coke in domestic appliances and the design of the appliances, and at the Building Research Station from the point of view of the heat requirements of a house as affected by the method of construction, weather conditions, &c.

The investigation into the causes of fires in bunkers or coal cargoes, which was undertaken at the request of the Board of Trade, has been completed, and a detailed report will be published in due course. It has been shown that fires due to spontaneous combustion of the coal without some ascertainable—and avoidable—contributory cause are rare.

Much consideration has been given to the use of pulverised coal for steam raising, though it has not been possible, as yet, to carry out much large-scale work on this question at the Fuel Research Station. Increased attention is now being given to the subject, with the special object of ascertaining the fundamental facts that underlie the correct design of burners and furnace and the behaviour of coal when it is burnt in a pulverised form. A number of vessels, both in this country and in America, have had their boilers adapted experimentally to use pulverised fuel, and close touch has been kept with the trials that are in progress.

The study of the problems involved in heat transfer has been continued, and it is hoped to publish during the year a small book dealing with this subject and giving a summary of the available data in a form suitable for practical application.

SIXTY YEARS AGO.

In the late 'sixties of last century the Indian Public Works Department was gradually passing from military to civil control. Formerly military officers had exercised supreme authority in all matters connected with public works in India, but in process of time civil engineers had come to hold some of the highest appointments in the service. The change was not at all to the liking of the military members. If we are to believe the evidence given in an article in our issue of October 29th, 1869, they sought to check the supply of civil engineers to the Department by causing to be issued an official order which in effect libelled the whole civil engineering profession in Great Britain. This order, reprinted in full in our columns, stated that the Governor-General in Council had been given to understand that in England it was a recognised practice for civil engineers employed by public companies and otherwise to receive, in addition to the salaries paid them by their employers, commissions on contracts given out or on stores or materials ordered or inspected by them, and that these pecuniary considerations were considered legitimate sources of emolument. The Governor, therefore, ordered that every person in the Public Works Department must consider his salary or pay as his sole legal remuneration, and that the receipt of any commission or any other direct or indirect consideration was prohibited. He further ordered that every Government officer must report to his departmental superior any infringement of the rule which might come to his knowledge. We were hotly indignant at this "unwarranted and gross insult" to the civil engineering profession. It was unjust, we wrote, that the shortcomings of a few dishonourable individuals should be represented as the recognised practice of British civil engineers. There was no foundation for the charge, and it was, we asserted, no more applicable to the general body of civil engineers employed by the Indian Government. The Council of the Institution of Civil Engineers acted promptly in the matter. It met, passed several resolutions on the Government's order, and sent a deputation to interview the Duke of Argyll, then Secretary of State for India. So long as the objectionable document remained in force or was not amended in such a way as to satisfy justice and truth, it would be impossible, we contended, for any engineer possessing the least particle of self-respect to accept service under the Indian Government. The incident seems to have closed soon afterwards with the issue by the Government of India of a clumsy attempt at explanation, in which it was asserted that the original order was merely intended to embody in the Public Works Code a prohibition against the receipt of commission which that code had not previously contained.

Obituary.

SAMUEL WHITMORE.

The death of Mr. Samuel Whitmore is announced as having taken place, following an operation, at his home, Seaton House, Newport, Mon., on Sunday, October 13th. Mr. Whitmore, who was born in Staffordshire in June, 1860, had been connected with John Lysaght, Ltd., of Newport, for 51½ years, latterly as chief engineer and as manager of that company's Roll Foundry, Swan Garden Works, Wolverhampton. He was chiefly responsible for the lay-out of the Orb Works at Newport, and also of the Australian Mills. To him, too, the enormous output of shells, which the firm produced during the war at the Macsglas Shell Factory, was largely due. Mr. Whitmore was elected member of the Iron and Steel Institute in 1903. He was a Director of Wright's Chilled and Grain Roll Company, Ltd., of Tipton, and of the Lowmoor Iron Company, of Bradford. He was also a Harbour Commissioner for Monmouth.

MITSUI COMPANY—TSURUMI ENGINEERING WORKS, JAPAN

(*For description see opposite page.*)

FIG. 14—30,000-kVA SYNCHRONOUS CONDENSER

FIG. 15—4500-kW SYNCHRONOUS CONVERTERS BEING ERECTED

Japanese Engineering Industries.

No. II.*

SHIBAURA ENGINEERING WORKS, TOKIO.

In 1893 the Mitsui Company, then developing into a concern of world-wide interests, established as one of its numerous subsidiaries the Shibaura Engineering Works for the manufacture of electrical machinery and apparatus. Gradually the enterprise expanded into an important organisation, and in course of time it became practically independent as a limited liability company (*kabushiki kaisha*). In 1910 it joined interests with the General Electric Company of the United States, and since that date, owing to increasing business, has repeatedly expanded its capital, which to-day amounts to twenty million yen. The president of the company is Mr. K. Iwahara, and the managing director Dr. I. Notomi.

In 1925 there was completed the first stage of the construction of the Tsurumi Works, the largest of their kind in the Far East, which cover an area of 4130 acres, 400 acres of which are occupied by shops and other buildings. In contrast with this development are the original Tokio Works, on a site now included within the Tokio harbour area, which are 840 acres in extent, over half of that area being occupied by shops.

The chief productions of the Tokio Works are transformers, switchboards, switchboard apparatus, protective devices, automatic voltage regulators, small motors and generators, fan motors, heating apparatus, radio apparatus, and other articles for domestic use; while the Tsurumi Works produce alternating-current and direct-current motors and generators of larger capacities, synchronous converters, induction regulators, controllers, winches, electric locomotives and railway equipment.

In common with many others, the company suffered severely from the disaster of 1923, when the construction of the Tsurumi Works was about to begin. The Tokio main office and shops were gutted in the great fire, the loss being estimated at seventeen million yen, few concerns suffering to so great an extent. The situation was aggravated by failure to recover insurance; this also, unfortunately, being a common experience of those who insured only against fire.

The disaster was not only a severe blow economically, for all technical data, the accumulations of years, were destroyed, and in fact the company had to begin all over again. It is therefore to the credit of all, executive and workers, that rehabilitation was effected in six months, and at the same time decided improvements were made in organisation and the efficiency was increased.

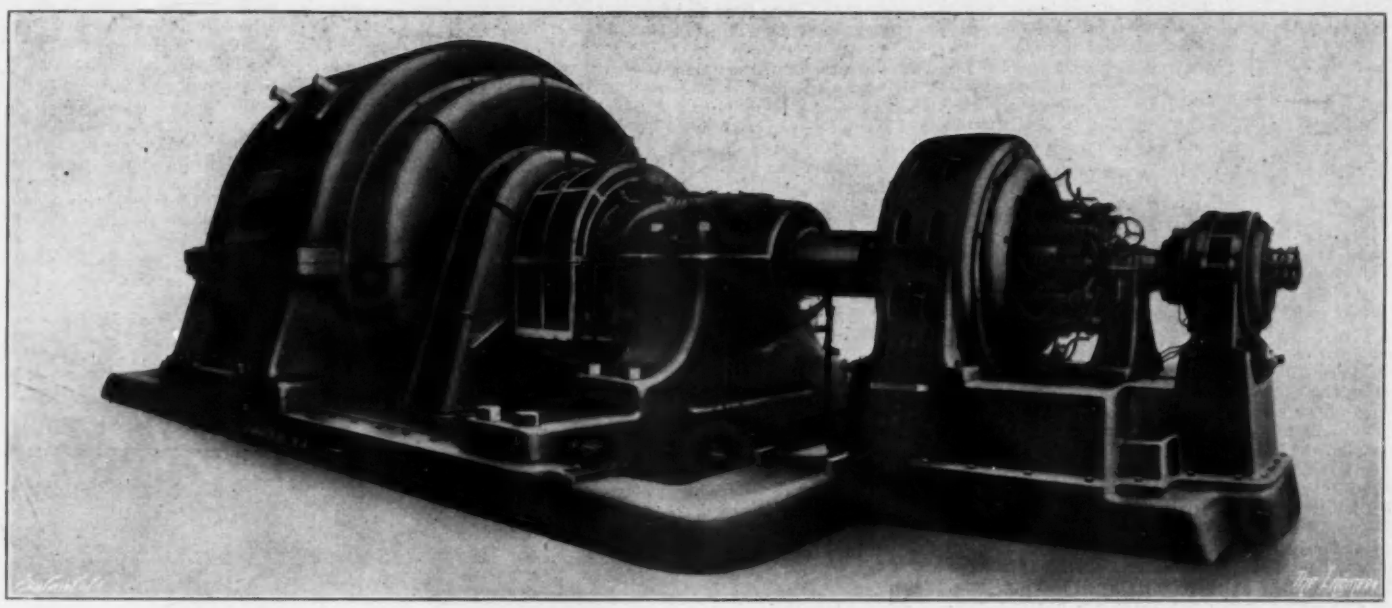


FIG. 16—30,000-kVA ASYNCHRONOUS CONDENSER

TSURUMI WORKS.

The construction of Tsurumi Works was prosecuted until completion, in August, 1925, of the first stage, which consists of the heavy machine shop, pattern shop, controller shop and warehouse. The capacities of these buildings are large, the area covered by them being 400 acres, nearly as large as the Tokio shops, although only partly finished. The heavy

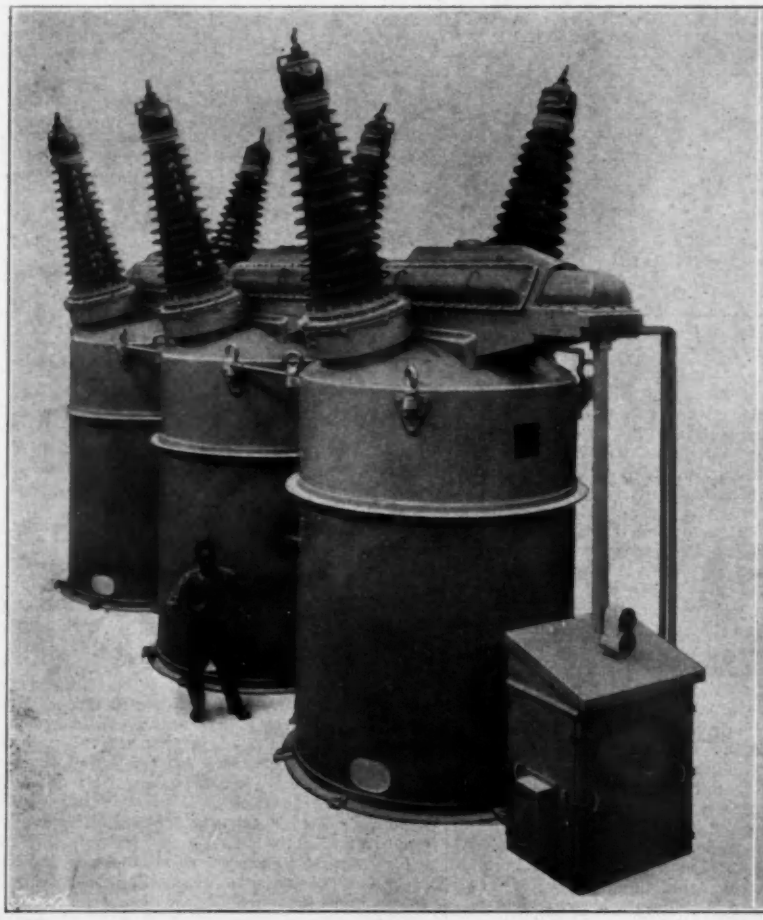


FIG. 17—175,000-VOLT OIL CIRCUIT BREAKER

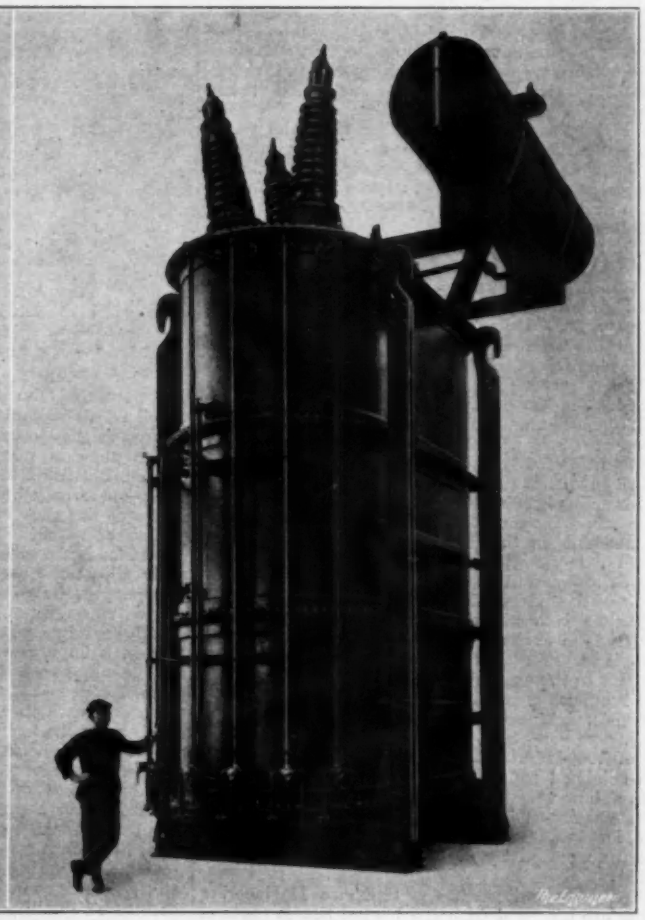


FIG. 18—36,000-kVA TRANSFORMER

* No. I. appeared October 18th.

machine shop alone covers 200 acres. The floors of all buildings where heavy machining is done are of concrete and wood block, while iron floors are provided for large portable machine tool work, erecting, and testing purposes. Lighting, ventilation, heating, and fire protection are all modern in design and the number of machines installed amounts to seven hundred.

The works are equipped with over eighty cranes of from 1 to 112 tons capacity, besides lifts, battery trackless trucks, and electric railways within the compound over 4 kiloms. in length. There is a splendid water front, 728 m. long, where vessels of 10,000 tons can tie up against the sea wall. Landwards, the works connect with the Government Railways. Because of easy access to land and sea many great factories and kindred concerns are establishing themselves in the Tsurumi and Kawasaki districts, so conveniently situated between Tokio and Yokohama.

Some Records.

Among the latest comers in the industrial field, Japan is achieving records. Of alternating-current generators, several 15,000-kVA units have been turned out since last year, and at present three 20,000-kVA and three 23,000-kVA units are under construction. The latter are to have full automatic control, and will be among the very few of their kind in the world. Complete sets of controlling equipment are also being made by the company.

What appears to be a world record was made by the company last year with an asynchronous condenser, 30,000 kVA, which, when operated, showed excellent results. Subsequently the company manufactured several like machines rated at about 10,000 kVA, and by so doing created a new epoch in the application of the phase advancer in Japan. Simultaneously the manufacture of the synchronous condenser has made rapid strides. Machines as large as 15,000 and 20,000 kVA were turned out last year, while at present larger machines are nearing completion, reaching 30,000 kVA at a bound. A synchronous condenser of that size is shown in Fig. 14, page 472.

As regards synchronous converters, a large order was booked last year—thirty-nine units of 4500-kVA machines—the majority having already been constructed. Some have been put in service, and operating results are better than was expected. A view, taken in the shops, showing some of these 39 machines in course of erection is given in Fig. 15, page 472. The alternating-current side of the machine has 30 poles and is wound for 6-phase, 60-cycle current. The direct-current volts and ampères are 500 and 9000 respectively. The speed is 240 r.p.m. The company has made to order numbers of three-phase 36,000-kVA water-cooled transformers, and single-phase 22,000-kVA 140,000-volt self-cooled transformers.

Of high-voltage apparatus other than the transformers mentioned, there has been built a number of oil circuit breakers and lightning arresters, both for voltages as high as 180,000. Some of the former have a rupturing capacity of 1,500,000 kVA.

The company has produced several varieties of electric locomotives, including 108-ton locomotives built last year for the Imperial Government Railways, and 80-ton locomotives with side-arm collectors furnished recently to the South Manchuria Railway Company, Ltd. It has supplied a number of mercury arc rectifiers with steel in place of glass vessels, though it is not long since this apparatus was first put on the market. They are made in sizes ranging from 300 kW to 750 kW, and some have been designed for full automatic operation, and the company is now prepared to make rectifiers of as large capacity as 2000 kW.

Illustrations of some others of the firm's production are given herewith. Fig. 16 shows a 30,000-kVA asynchronous condenser which was made for the Tokio sub-station of the Nihon Denryoku Kaisha. The machine on the left is the main machine—50-cycle, 11,000-volts, running at 500 r.p.m. The weight of both stator and rotor is 80 tons, while the total weight of the machine is 210 tons. The machine in the centre is a 300-kVA low frequency generator, which is the exciter of the main machine. On the right is a 10-kVA frequency changer, which is auxiliary to the exciter. It is claimed that the largest asynchronous condenser previously built was a Siemens' machine of 15,000 kVA operating in Germany.

The 36,000-kVA transformer which is shown in Fig. 18 is also claimed to be a world's record. It was built for the Chosen Hydro-electric Company, and is of the 3-phase water-cooled type. An oil circuit breaker built for 175,000 volts and 400 ampères, with an interrupting capacity of 1,500,000 kVA, is shown in Fig. 17.

As already indicated, the Shibaura Engineering Works are affiliated with the United States General Electric Company, and are therefore in a position to benefit by the exchange of technical practice. Their output is designed to meet local requirements, and despite the serious economic and financial difficulties now facing Japan, material and technical progress is being made, the natural result, perhaps, of thirty-five years of pioneer effort in the engineering field.

(To be continued.)

North-East Coast Exhibition.

No. IX.*

SHOE-MAKING MACHINERY (*Conclusion*).

After the sewing operation the channel in the sole is closed again, to protect the stitches from wear, by means of a corrugated wheel, which rubs the lip down. A separate sleeking tool operates round the edge of the sole at the same time and beats the welt back.

The shoe is now subjected to another pressing, to consolidate the sole, in the machine shown in Fig. 9. There are two iron feet in this machine, which are used alternately, so that one shoe can be pressed while another is being put in place. Each of the iron feet, it will be seen, is mounted on the end of a circular column on adjusting slides, so that various sizes and shapes of shoe can be accommodated. The columns slide in substantial sleeves, which are mounted on trunnions, and the trunnion shaft is so driven that the iron feet are alternately presented in a vertical position for the reception of a new shoe. When the starting treadle of the machine is depressed, the newly charged foot is swung forward on its tunnion, and the shoe is presented to a shaped iron form. Pressure is then brought to bear between the shoe and the form, and the trunnion is given a swinging movement by means of cranks that rocks the shoe back and forth on the form in simulation of the movement of walking. This action is repeated several times, automatically, and thoroughly beds down the sole. The pressure, which is considerable, is then released, and the foot returns to the charging position.

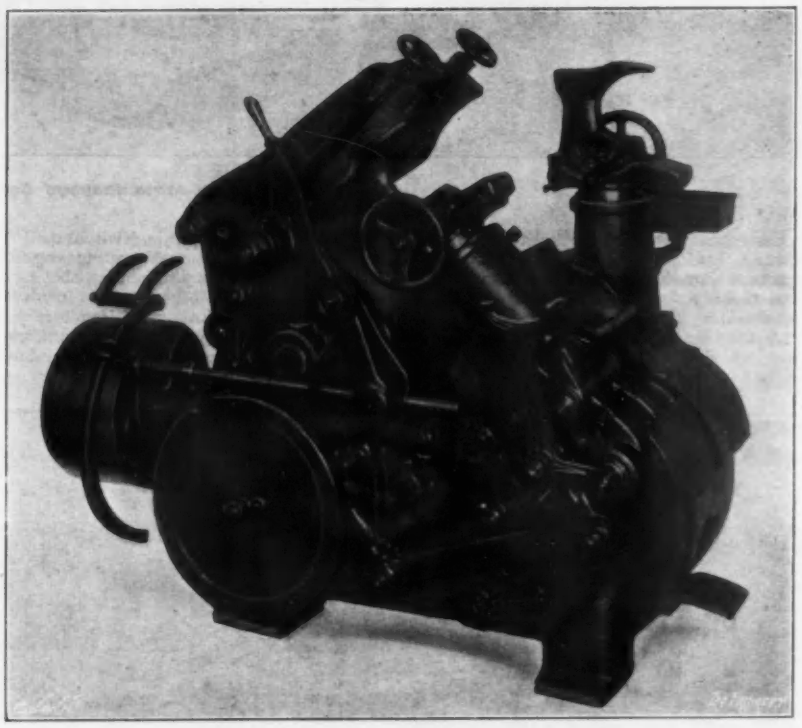


Fig. 9—Levelling Machine

The shoe is now taken to the heel-attaching machine illustrated in Fig. 10, which drives a number of nails—there may be as many as twenty—from the inside of the shoe into the heel. This operation is performed with the shoe upside down, so that the attendant has a good view of his work, and can properly adjust the shoe in place. The nails used for this purpose have twisted flutes, and may be considered as screws of extreme pitch. They make one or more revolutions as they are driven. The nails are held in a hopper and gravitate down a number of flexible tubes to a loading device. This device is a plate of approximately the shape of the heel in which there are a number of holes, corresponding to the number of nails to be driven. A nail is dropped into each of these holes, according to the arrangement of the feed pipes. The plate is then swung across the machine on an arm, and deposits the nails, point upwards, over a post on which the shoe is placed. The attendant then puts the heel in place on the shoe, beneath a top plate, and the nails are driven, upwards, by spring cushioned plungers. It is noteworthy in this connection that the drive involves two distinct blows. There is the main blow, which puts the nail in place, and then there is, quickly in succession, a short, sharp blow that beds down the nail and prevents it from springing back out of the material.

It will be readily appreciated that the effort of driving all these nails simultaneously is considerable, and that the clutch mechanism which is involved must be substantial. There is also a powerful brake on the drive, which comes into operation immediately the brake is released, to stop the mechanism at the top of the stroke. During the nail-driving process, the loading device is returned to the position where it receives a new supply of nails, so that the process is almost continuous, and as many as twelve hundred pairs a day is a reasonable output from one of these machines.

It might be said that the construction of the shoe is now completed, but it requires a number of operations in the way of finishing to make it ready for the market, and most of these processes are carried out on comparatively simple machines, which somewhat resemble those used in fettling castings in a foundry. There are, however, several machines of rather intricate design, which are involved in the finishing of the shoes. It should be pointed out, incidentally, that at this stage the last is re-inserted in the shoe, and that the finishing operations are carried out with the shoe supported in this manner. The grinding effect of these processes naturally produces a considerable amount of dust, and the machines used are consequently generally grouped together, with a common system of ducts for taking away the dust and separating it in a cyclone apparatus. At the Exhibition, however, it was necessary to discharge this air within the building, so a dust filter was installed for its treatment.

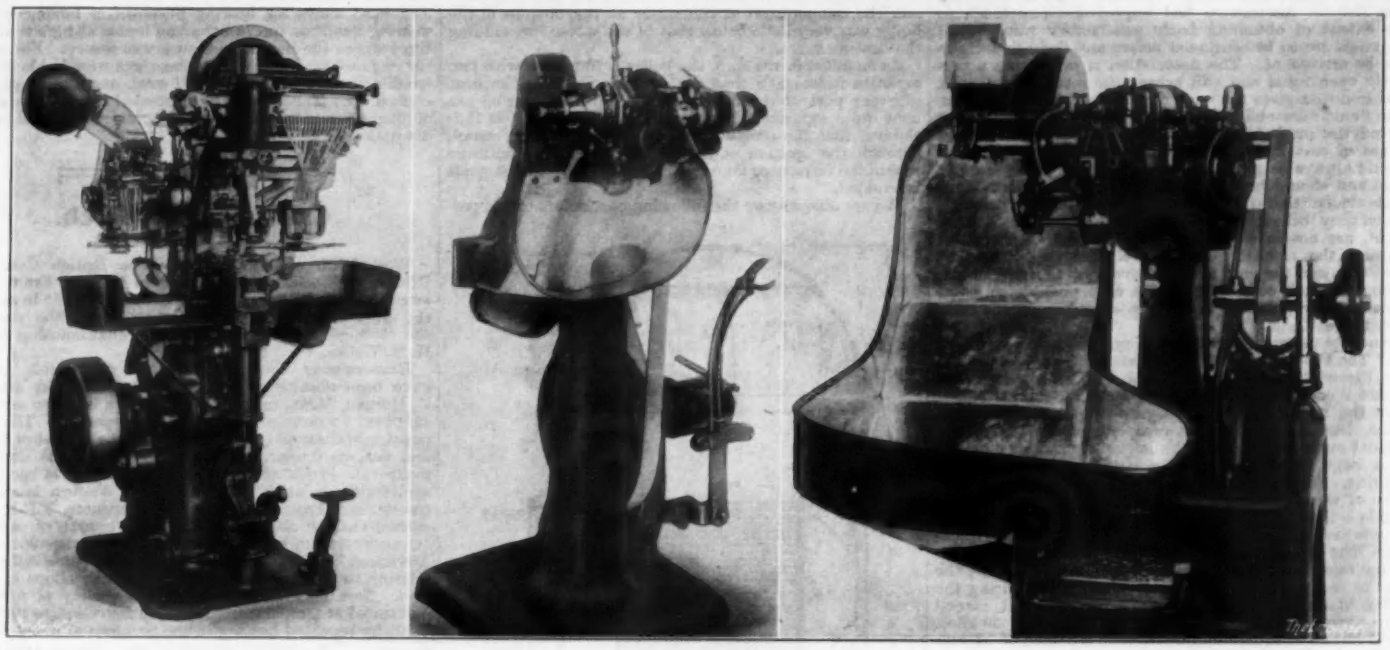
The first machine which is used in the process of trimming the rough shoe is that shown in Fig. 11, which trims the rough heel to the required shape. It carries two semi-circular cutters, the shape of which corresponds to the reverse contour of the heel. The revolving head in which they are carried adjusts itself to the height of heel, taking care of heels that are not uniform in height or that differ in height back and front. It is hard work holding the shoe up to the cutters compared with most of the operations already described, particularly as the operator has to rotate the shoe to trim all around the heel. He can, nevertheless, keep pace with the output from the heel attacher.

The name of the jointing machine shown in Fig. 12 is almost a misnomer, as jointing is a term applied to the removing of the projection which remains at the junction of heel trimming and edge trimming. The different diameters of the cutters used for these purposes and the fact that the circular waist trimming cutter can only approach the square corner formed by the front of the heel within a measured distance provides a problem in grinding which is rather difficult to meet. The machine now generally employed in this process combines what were formerly two distinct operations, edge trimming and jointing or "knifing up." Trimming cutters or formers of specific shape produce the shape of the finished edge of the forepart and waist. These cutters are, necessarily, easily changed to accommodate the varying shapes and different thicknesses of soles.

The jointing mechanisms constitute a planing knife which, reciprocating at high speed, continues the trimming to the heel. Another knife working in conjunction with it leaves a cleanly cut, well-defined corner. This machine carries its own grinder for sharpening the knives. The shoe is then passed to a scouring machine, the essential features of which are two rolls mounted on a shaft running in ball bearings, upon which there are respectively rough and smooth sandpaper or other abrasive material of width and contour depending on the shape of the heels to be

* No. VIII. appeared October 25th.

SHOE-MAKING MACHINERY



FIGS. 10 AND 11—HEEL ATTACHING AND TRIMMING MACHINES

FIG. 12—JOINTING MACHINE

scoured. These give a smooth surface to the heels, finishing the work started by the trimmer. The rolls are necessarily split but are easily locked in order to facilitate the frequent renewal of abrasive. Similar in general principles of design is the universal heel finishing machine, but the shaft in this case carries a padding roll which deposits a thin film of wax over the heel. At the Exhibition the heel was first inked or coloured by hand. The roll receives its supply of wax from another metal roll partly submerged in a bath of wax, the whole being heated electrically and

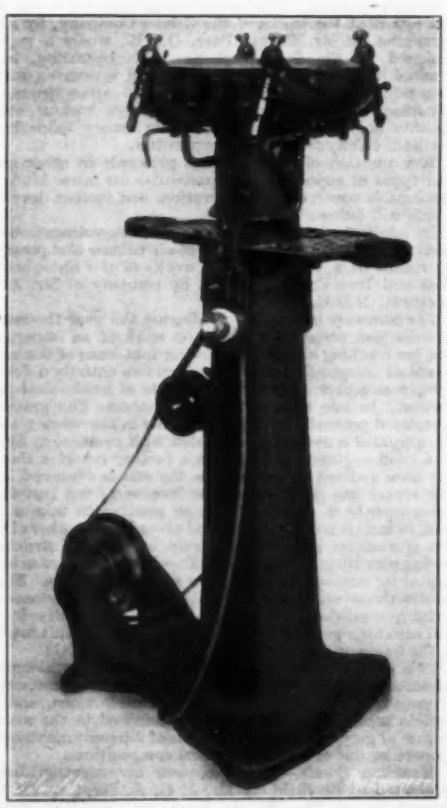


FIG. 13—EDGE SETTING MACHINE

maintained at an even temperature which must not destroy the properties of the wax. The shaft carries also a rotary seat wheeling tool, also heated, which makes a series of parallel impressions or indentations at the base of the heel where it joins the upper. There is also a polishing brush on the spindle.

The edges of the sole in forepart and waist are "set," after waxing, by pressure and friction to compress the fibres to make the edges impervious to water, and generally to improve their appearance. Formerly the complete operation was performed on the Regal edge setting machine shown in Fig. 13, and was considered one of the most fatiguing duties. This machine is used now only in setting "waists," a comparatively light job. The head of this machine is rectangular in shape and at each corner there is a setting iron, heated by gas or electricity. These irons are shaped similarly to the edge to be set and receive a rapid reciprocating motion. The machine is worked by two operators, each using one side with two irons.

The automatic edge setting machine shown in Fig. 14 has, however, largely supplanted the Regal machine and is one of the most interesting, from a mechanical point of view, used in the shoemaking industry. It suggests, in fact, the importation of a style of thought which was not too rigidly guided by old traditions.

The function of this machine is to "iron" the

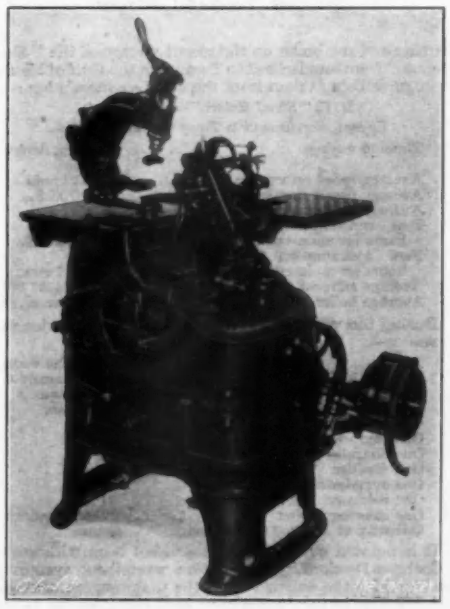


FIG. 14—EDGE SETTING MACHINE

edges of the sole, to make them stiff and fair in appearance. The ironing is effected by a little block of metal, which is heated electrically, and is pressed against the shoe by a most ingenious mechanism that faithfully follows its contour. The shoe itself is held in a "jack" to which there is given a movement that approximately follows the shape of the edge of the sole, so that that edge is offered up to the iron, right round the circumference of the shoe, and the slight oscillating movement which is given to the iron produces the desired "setting" effect. The iron must, however, follow the contour of the edge in three dimensions with real accuracy. For this reason there are two little feelers, which bear against the outside and the bottom of the sole edge. These feelers are carried by stalks lying at an angle of about 45 deg. which terminate in a device similar to a Hooke's joint. As a consequence of the relative extension and contraction of the stalks as the feelers follow the curvature of the shoe the Hooke's joint is, more or less, rotated, and this rotation is employed to operate valves in a hydraulic system which constrains the oscillating iron to follow the contour of its work. The pressure exerted by the iron in a horizontal direction is determined by springs. The hydraulic pressure for the other movements is provided by a pump which, working against a loaded relief valve, maintains a constant pressure of 120 lb. per square inch.

The mechanism which gives the shoe its roundabout movement completes one or more cycles and then comes to rest, while at the same moment the oscillation of the iron is stopped, so that no finishing blemish is left. The operator can consequently set a shoe in the machine and leave it unattended for the setting process to proceed, while he handles another shoe in another machine for touching up any corners in the waist not reached by the automatic machine. This equipment is capable of dealing with 400 pairs of shoes a day.

From this point onwards the finishing of the shoe involves processes and machines more or less in the nature of polishing buffs, and it hardly seems necessary to describe this part of the manufacture in detail.

French Foundry Congress.

THE Congress organised by the Association Technique de Fonderie and held on October 25th and 26th at the Ecole Nationale des Arts et Métiers in Paris, under the Presidency of Monsieur André Damour, gave special prominence to methods of testing cast iron. To this extent it was a continuation of the discussion at the London Congress in June last, and it was quite evident that the feeling of disappointment caused by the rejection of the French proposals has not been allayed, which is regrettable in the interests of international collaboration. Monsieur Ronceray declared that the British foundrymen had entirely misunderstood the French, who, he said, had never proposed to let the shearing test stand alone, but to make it an element of a series of tests. The proposal was put forward as a basis of discussion. Professor Léon Guillet was more emphatic in expressing his opinion on the manner in which the British had refused to discuss the French proposals. It is desirable that this friction should be smoothed over, for the misunderstanding will make it more difficulty to conciliate the British and French views and may possibly result in separate testing methods being eventually adopted.

The subject matter was introduced by Monsieur Le Thomas, who read a paper in collaboration with Monsieur R. Bois on "Methods of Testing Cast Iron." He said that they proposed the shearing test in combination with a static flexion test and a Brinell test for hardness. Nevertheless, it was clear all through the discussion that shearing was regarded as the crucial test, and the authors endeavoured to prove that there was such close agreement between the results obtained with shearing and with tensile tests that there could be no doubt as to the reliability of the former. Still, there were discrepancies, some of them serious, and the discussion left the meeting uncertain whether a close concordance between the two really existed. Finally it was concluded that the discrepancies were due to the unreliability of the tensile tests. It was declared that these tests were fundamentally irregular owing, it was understood, to the want of homogeneity in cast iron. The whole discussion was a plea in favour of shearing, and it was mainly devoted to overcoming the practical difficulties, which are great. A communication from the Association Technique de Fonderie de Belgique gave

results of trials with a Frémont machine, and found, what had been experienced by everyone else, that there was great trouble in getting small straight test pieces of absolutely correct diameter and then holding them in the machine so that they could be sheared without breaking. The Belgian Association had improved its methods to the extent of obtaining fairly satisfactory results, and the trials are to be continued before any definite decision can be arrived at. The Association is preserving a perfectly open mind and will accept the method of testing cast iron that gives the most regular and accurate results. The French are obliged to admit that they have not yet solved the mechanical difficulties of shearing small test pieces of cast iron. It is indispensable that the shears should always be ground to identically the same shearing edge and should be maintained in that condition. It is quite evident that the French, while introducing a principle which they believe to be sound but wh ch needs definite proof, are not in a position to adopt the shearing test because the mechanical means of doing the work are defective, and they are now endeavouring to perfect those means and are collecting all the data possible so as to present their proposal in a more complete form at the Congress at Liége.

Another paper that provoked long discussion was that on "The Production of High Resistance Grey Cast Iron in the Electric Furnace," by Monsieur E. Valenta, of the Skoda Works. The claims made for electric smelting are that the metal does not come into contact with burnt gases, the foundryman has complete control over any desired quantity of metal, the impurities can be removed to a large extent, the metal can undergo a process of refining, and the temperature is only limited by the resistance of the refractory lining. The process employed at Skoda is the Duplex, and the author declared that the cost of producing this high resistance cast iron is not more than that of ordinary high grade cast iron, while, in view of the fact that the use of smaller sections is possible, the cost is really lower. This claim was refuted during the discussion. Test pieces, 30 mm. diameter and carried on centres 600 mm. apart, showed a resistance of 50 kilos. to 75 kilos. per square millimetre with a fl xion of 12 mm. to 18 mm. The graphite is very fine and evenly distributed.

In the discussion the high quality of cast iron obtainable in the electric furnace, which gives the foundryman perfect control over the mixture and the heat, was fully recognised, but objection was taken to the paper in minimising the value of other cast iron, the object of the communication being avowedly to present the electric product to users, and it was declared that the technical data were somewhat biassed. The tables given were criticised on the ground that the foundry could produce much better cast iron than that which Monsieur Valenta placed in comparison with the electric product. Those using the Duplex furnace in France stated that the results so far obtained were satisfactory, but that it was a mistake to suppose that cheap cast iron could be produced in the electric furnace; it produced a superior grade cast iron and its cost was high.

A communication on "Cast Iron Parts for Agricultural Machines" was received from Mr. H. Bornstein, of Moline, Ill., U.S.A., who gave interesting details of the foundry practice at one of the largest agricultural engineering factories in America. He remarked that in 1928 the manufacture of agricultural machines in that country absorbed 100,000 tons of malleable iron castings out of a total production of 880,000 tons. This paper interested particularly those ironfounders associated directly with agricultural engineering, since it showed the importance of organisation as a means of increasing production, a point which was stressed in the President's inaugural address, when he insisted upon the necessity of improved organising methods in the ironfoundry industry as a whole; and Monsieur Ronceray urged that French agricultural engineers should go closely into the matter of increasing the foundry production and reducing labour costs. Many other papers were presented and discussed.

A Composite Exhaust Gas Boiler.

For some time past the firm of Cochran and Co., Annan, Ltd., has been engaged in the design of a special water-tube vertical boiler, which can be simultaneously employed for oil firing and the recovery of the waste heat from the exhaust gases of marine oil engines. The first boiler of this new type, a section through which is given in the accompanying engraving, was recently installed on the motor vessel "Sheaf Holme," of the Sheaf Steam Shipping Company, Ltd., of Newcastle-upon-Tyne—managing owners, W. A. Souter and Co. The ship was built at Sunderland by William Pickersgill and Sons, Ltd., and was engined by William Doxford and Co., Ltd. The propelling machinery comprises a three-cylinder Doxford opposed-piston oil engine, with a designed output of 1500 S.H.P. The deadweight carrying capacity of the vessel is 8700 tons and all the auxiliary machinery is steam driven, the necessary steam being obtained from the boiler we are describing.

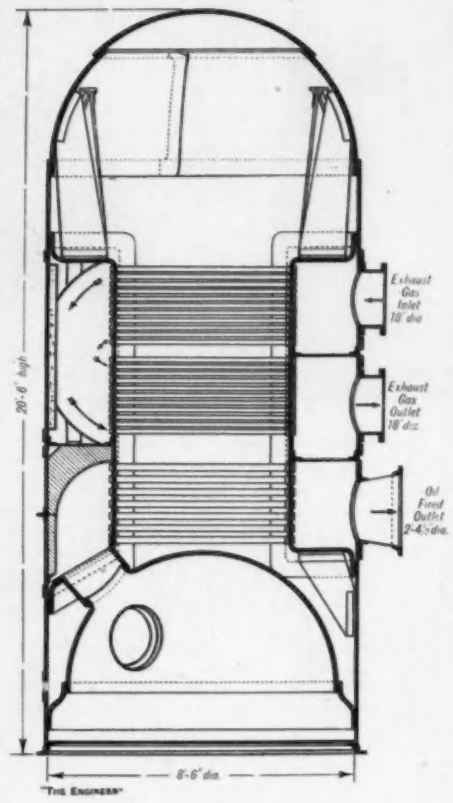
From the drawing given, it will be seen that the boiler is furnished with two upper nests of tubes for waste heat recovery and a lower nest of tubes for oil firing, which latter tubes are in direct communication with the furnace. All the tubes are secured between two common tube plates. The two upper nests are furnished with 1¼in. external diameter tubes, there being 311 tubes and 41 stay tubes in the top nest and 297 tubes and 55 stay tubes in the second nest, making in all 704 tubes with about 1390 square feet of heating surface for the waste heat recovery. The oil-firing portion of the boiler is fitted with 102 tubes and 29 stay tubes, each of 2½in. external diameter, with a total heating surface of about 500 square feet. The grate area is 41 square feet and the designed working pressure is 120 lb. per square inch. The oil burner used is of the Wallsend low-pressure air type.

During bench trials which were carried out at Messrs. Doxford's works, the boiler was coupled to a 2000 B.H.P. engine. It evaporated 0·84 lb. of water per hour from water at 60 deg. Fah. to steam at 100 lb. per square inch per B.H.P. During these trials no auxiliary oil firing was used. The exhaust gases entered the boiler at 710 deg. to 720 deg. Fah., and the drop in temperature through the tubes was a little over 300 deg. Fah., giving an outlet temperature of about 400 deg. Fah. The back pressure was found to be small, and by water gauge it was 8in., or 0·29 lb. per square inch.

The circulation of the water within the boiler was good, and the temperature of the water at the bottom of the boiler was very little below that of the water surrounding the heating tubes.

As installed in the ship, the boiler is furnished with two separate funnels, so that the waste gases from the heat recovery part of the boiler and the oil-fired portion are kept quite separate. The arrangement is such that it is claimed that the possibility of an explosion being caused through the ignition of an oil vapour and air mixture within the furnace or flues by the heat of the exhaust gases is avoided.

We are able to give the following particulars of the performance of the boiler on the recent voyage of the "Sheaf Holme" from Sunderland to Tampa, in the Gulf of Mexico, the figures being taken from the chief engineer's log:—



SECTION THROUGH BOILER

M.V. "Sheaf Holme," Voyage No. 1.

Voyage, Sunderland to Tampa; Ballast Trim.

Time on voyage	19 days, dock to dock
Average speed on voyage	10·43 knots
Average power developed	1600 I.H.P.
Average engine revolutions	85 r.p.m.
Fuel consumption per twenty-four hours for main engine	5 tons 6 cwt.
Fuel consumption per twenty-four hours for main engine and boiler	5 tons 7 cwt.
Average exhaust temperature	About 670° Fah.
Average boiler pressure	90 lb. per sq. in.

During the voyage the following steam auxiliaries were in use:—

	Total for the voyage.
One 12½-kW dynamo	Continuously
One general service pump	Continuously
One bilge pump	17½ hours
One fuel transfer pump	13 ,,
One compressor	7½ ,,
One Sharples purifier	97 ,,
One distiller	41 ,,
One evaporator	42 ,,
One refrigerator	81 ,,
One steering engine	When required
Quantity of distilled water used	3 tons

It is pointed out that had the vessel been without the "Cochran-Doxford" combination waste-heat system for dealing with the exhaust from the main engine, the total consumption of fuel would have been increased by 1½ tons per day, making a total consumption per day of 6·8 tons.

MANCHESTER ASSOCIATION OF ENGINEERS.

At a meeting of the Manchester Association of Engineers on Friday last, October 25th, a paper on "Bearing Alloys" was read by Mr. R. T. Rolfe, F.I.C. It was subdivided into several sections dealing with the requirements of a bearing metal; bearing alloys used in commercial practice; constituents of tin base bearing alloys; the variations of structure during cooling; the adhesion of the joint; the practical procedure in lining; copper-tin bearing alloys; phosphor bronze; and zinc base bearing alloys. Reference was made by Mr. Rolfe to a German invention in which bearing bushes are made of pieces of limestone embedded in white metal. Before the metal is cast round them the stones are put in sheet metal gutters which run from end to end of the bearing. Boring is performed by a diamond tool. It is claimed for this type of bearing that the limestone, being porous, absorbs oil and quickly becomes polished when the bearing is put into service. Such bearings, the author states, are used on tramcars in service in Leipzig, Chemnitz and Hamburg, and have a life of between 35,000 and 45,000 miles. Mr. Rolfe stated that, in general, tin base alloys were superior to all lead base alloys for bearing purposes in having greater wearing qualities and in behaving better at high temperatures where the bearing pressure was severe. For motor car engine bearings lead base bearings were liable to give trouble as they became burred over, and the oil grooves choked up. The paper was illustrated by a large number of diagrams and lantern slides, and gave rise to considerable discussion.

Cast Iron Research.

The eighth annual report of the British Cast Iron Research Association has just been issued. From it we learn that the following progress has been made in some of the chief investigations undertaken during the year by the Research Committee, under the chairmanship of Mr. H. B. Weeks.

Heat-resisting Cast Iron.—Some remarkable results have been obtained by the senior metallurgist and Mr. E. Morgan, M.Sc., on alloys which have hitherto not been supposed to possess heat-resisting properties. The composition of these alloys has been made the subject of British and various foreign patents, after which it is hoped to make full disclosure to members. They have been tried sufficiently on an industrial scale to confirm laboratory results, and Professor Sir Harold Carpenter, F.R.S., who carried out the classical work on the growth of cast iron twenty years ago, has described the results as revolutionary. Advances have been made to overcome some difficulties relating to the mechanical strength of the alloys in question. Test bars were made from a variety of mixtures and tested at temperatures from 600 deg. Cent. to 1000 deg. Cent. by repeated heating in the presence of moist carbon dioxide. The increases in weight and volume were noted after each heating. The results have not only radically modified existing views with regard to the effect of composition on growth, but have led to a clearer conception of the nature of growth and how it is affected by the ordinary elements of composition, and by graphite.

Some heat-resisting irons of the older type to a composition recommended by the Association were utilised in low temperature carbonisation retorts at the Greenwich station of the Fuel Research Board. It is understood that these retorts have been in service over a year, and have withstood growth and distortion to a highly satisfactory degree. For all-round suitability these irons have proved themselves to be excellent.

The Association has decided to undertake an investigation into the properties of the irons used in ingot moulds, and the support of ingot mould makers as a whole is being sought in order to enable the required data to be furnished.

Cupola Practice.—The experiments referred to in the last report at the works of the Carron Company, by kind permission of Mr. George Pate, O.B.E., where a cupola designed by the Consultant has been operating, have resulted in a very marked advance, and is pouring metal successfully into very thin sections. Apart from the advantage derived from coke economy, various other benefits not directly ascertainable in money value have resulted, chiefly from cleaner operation.

The question of applying this principle to other sizes and types of cupola, and in particular for other kinds of castings, is now under consideration, and further developments will follow.

In addition, a number of practical experiments have been made on the measurement of air volume and pressure by means of a Venturi at the works of the Sheepbridge Coal and Iron Company, Ltd., by courtesy of Mr. J. T. Goodwin, M.B.E.

The Structure of Cast Iron.—During the year the senior metallurgist prepared a report on work of an important and far-reaching character, showing that irons of the same chemical composition may solidify in two entirely different structures and with two differing sets of mechanical properties. In one system the iron contains fine graphite associated generally with ferrite, while in the other system the graphite is normally associated with pearlite, as found in a good engineering iron. In a further report a theory has been evolved to account for the effects observed, and this report was presented to the Iron and Steel Institute. Subsequently it was shown to be possible to take a pig iron, to melt it so that it solidified according to either of the two systems at will, and to change one type of structure during remelting to the other. These changes were accompanied by anticipated changes in mechanical tests. These results throw an entirely new light on the importance of melting conditions in the production of foundry irons, and attempts are now being made to follow up this matter in the foundry.

This development appears likely to have considerable influence upon current views respecting the manufacture of grey irons, chilled irons, and malleable irons, and to explain some of the anomalies experienced in the manufacture of grey irons and semi-steels of different mechanical properties, but of similar chemical compositions.

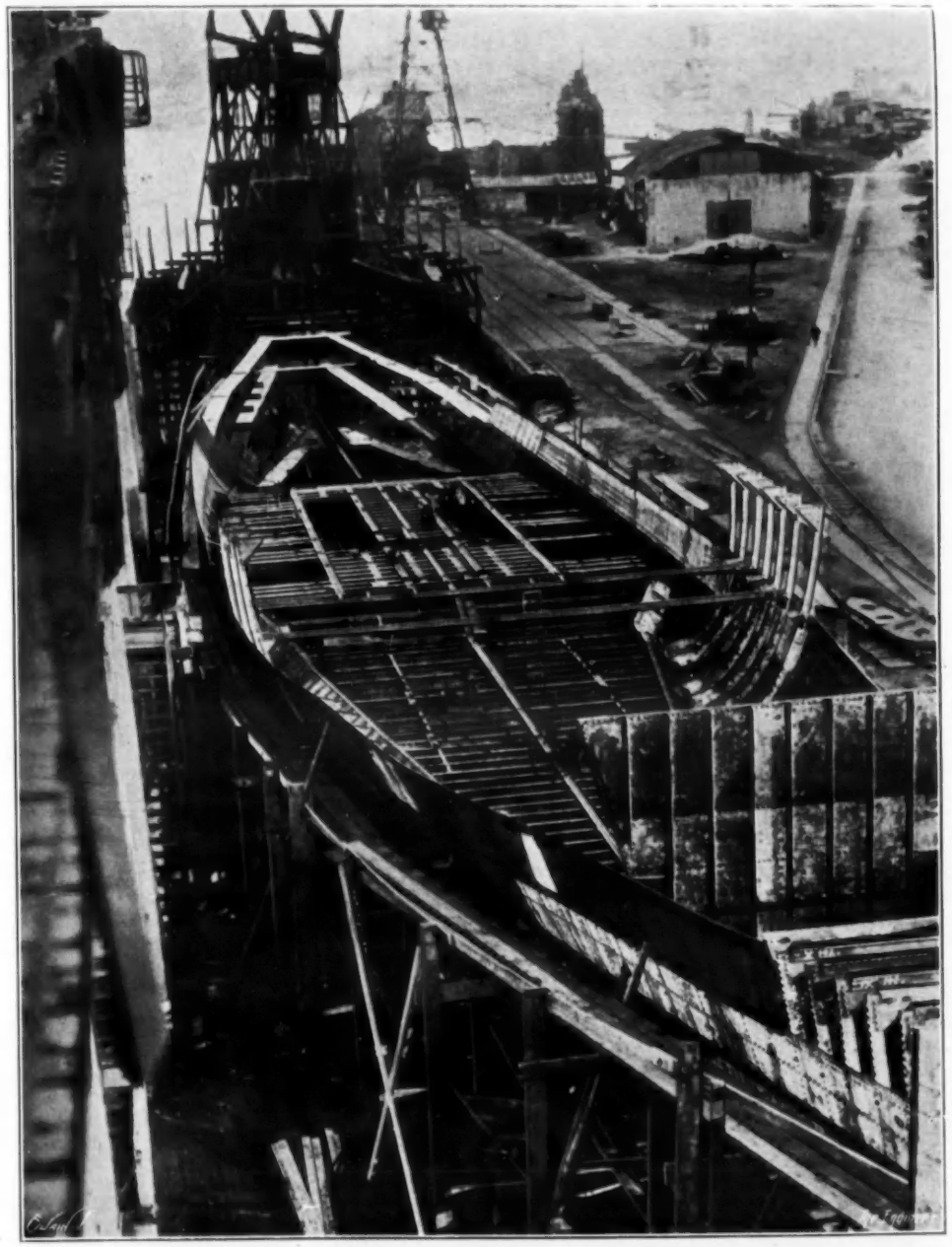
Moulding Sands.—The extensive investigation being conducted at Sheffield by Mr. J. G. A. Skerl, under the supervision of Mr. W. J. Rees, on moulding sands, approaches completion. A series of representative sands from beds drawn upon by ironfounders in different parts of the country have been very completely examined, and a report showing their comparative properties is in the press. After considerable investigation, two simple tests were chosen by the Sands and Refractories Sub-Committee as suitable for foundry control—the permeability test and the compression strength test. Arrangements have been made for the permeability tester to be supplied to members at the price of 75s. by the Association's approved supplier in Sheffield. It is hoped that the compression strength tester will be equally available shortly at a similar price. The completion of the laboratory work and the development of practical foundry tests brings the work to a point at which it can be applied in members' foundries, and it is hoped that the investigator will be able to spend in future a considerable amount of time in actual foundry visits.

HULL CONSTRUCTION AT THE MONFALCONE SHIPYARD OF THE CANTIERE NAVALE TRIESTINO

LOOKING AFT. OCTOBER 15TH. 1928

LOOKING FORWARD. OCTOBER 31ST. 1928

LOOKING FORWARD. NOVEMBER 12TH. 1928



LOOKING AFT. DECEMBER 12TH. 1928

UNIV. OF TOR.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Restricted Business.

TRADING in iron and steel in the Midlands and Staffordshire remains irregular, buying being restricted to small tonnages required for current consumption at the works. Peculiarly enough, the hesitancy and caution exercised are equally divided between the producer and the consumer. Iron and steelmasters' difficulties are increasing as a result of the challenge of foreign producers, who are, at date, quoting very low prices, alike for iron and steel. In some branches of South Staffordshire manufacture cheap foreign half-products are being increasingly used as an aid to effective competition in the open market for finished goods. There is no easing of the fuel situation, so that iron and steel masters cannot reduce selling costs in an effort to "hold" the market. Indeed, while continental prices are going down, native makers' prices are going up, and the disparity between British and foreign material prices is widening from both sides. Many patriotic manufacturers in this area and those pledged to the steelmasters to buy only British material, are supporting local works so that they are able to continue fairly regular work. The position is, however, a serious one, and industrialists generally in this district view the future with apprehension. The attendance on 'Change in Birmingham to-day—Thursday—was good, but little new business resulted from the meeting of representatives of the producers and consumers of iron and steel.

Staffordshire Bar Iron.

Staffordshire ironmasters are now distinctly turning their attention towards establishing a new basis of prices for Crown iron. The position is a very difficult one, and courage will have to be displayed, either in maintaining prices at the level existing to-day or in making an upward price movement. For a long time now demand for Crown quality bars of Staffordshire make has varied between poor and moderate, and at no time this year can business be said to have been really brisk. It is felt that any increase in price might be followed by a further falling off in demand. Then, again, Staffordshire ironmasters have severe internal competition to meet. For months past makers outside this district have been offering Crown iron on the Birmingham market at prices 5s. or more per ton below local makers' selling figures. True, it is claimed that Crown iron made in this district is superior in quality to that procurable from outside, but buyers have sacrificed quality to price. Large numbers of consumers of Crown iron have bought outside this district on the ground that it was necessary for them to buy cheaply to enable them to compete in the open market with the finished product. Despite these facts, most local ironmasters fail to see how they are to carry on their works profitably at present selling rates. Production costs have gone up considerably, and Crown bars have become so dear to produce that ironmasters cannot afford to dispose of them on the scale of charges now existing. Crown bars of Staffordshire make range in price from £10 to £10 5s. per ton. Many ironmasters consider they are worth £13 7s. 6d. per ton, and this, I understand, is the price they would like to see established as the new selling basis. There seems little chance of fuel and raw iron prices declining in the near future, or ironmasters might be tempted to continue accepting business at present rates in order to keep demand active until such time as a fall in production costs renders the present basis price remunerative. Under these circumstances, it seems highly probable that Crown iron prices will be advanced in the near future. The foregoing provides the matter of chief interest in the Staffordshire iron trade at the moment. In the best bar department conditions continue satisfactory. Demand is good and works are fairly busy. Though prices have recently been advanced 10s. per ton, sales, it is claimed, have not been adversely affected. Here, however, steelmasters are not faced with internal competition, so that Crown bar makers could hardly expect similar results to apply in their case. Staffordshire marked bars at £12 10s. per ton are in steady request. Common bars for bolt and nut and fencing making are quoted £9, but little business is passing, Belgian prices being such as to rule local bars "off the market." There is a considerable amount of foreign material coming into the mills and factories in the Black Country. Wrought iron tube strip is unchanged at £11 2s. 6d. per ton. Consumptive demand keeps up well.

Pig Iron.

The Midland pig iron market continues firm, despite the fact that users are supplementing existing contracts only in so far as current requirements necessitate. Transactions extending to the New Year are held, both by producers and consumers, to be too speculative to be worth the risk. The demand for foundry pig is sufficient to absorb the output of Derbyshire and Northamptonshire blast-furnaces. Prices are unchanged, Derbyshire No. 3 being £3 18s. 6d. and Northamptonshire £3 15s., delivered Black Country stations. Forge iron, which sells at 4s. per ton less in each case than No. 3 foundry, makes little headway towards recovery, and sales are few and of small content. News from the coke ovens is not reassuring, and Midland smelters continue to display anxiety on this account. Fortunately, the majority of Midland smelters have fixed contracts for coke until the end of the year, and have no occasion to purchase supplies on the open market at the high prices ruling to-day.

Formidable Steel Competition.

Foreign competition becomes more formidable in most branches of the steel trade week by week, and local steelmasters are wondering where it is all going to end. Continental quotations for bars, strip and billets are so low that home producers are experiencing the greatest difficulty in obtaining orders to replace those now being worked off at the local mills. The prices they quote are far from competitive, and it is perhaps only due to the present relations existing between producers and users in this country and to the superior quality of the British material that local steel works receive any orders at all. In the finished steel department constructional engineers are remaining loyal to the steelmasters' association, and buying "only British." Prices in this branch remain unaltered, and there is little, if any, change in values of native semi-finished steel. Here and there, however, so it is reported, sellers are making bargains with buyers of bars, strip and billets at slightly below the recognised market level, which is £8 2s. 6d. for small bars and £6 7s. 6d. for billets and sheet bars. It is held to be only in very exceptional circumstances, however, that this applies. Quotations on 'Change in Birmingham to-day—Thursday—were as last week.

Sheet Values.

Prices of 24 gauge galvanised corrugated sheets have subsided to £13, though half-a-crown in advance of this figure is required in the case of small-scale business. The continued weakening of values has given buyers the idea that mills will accept business at any figure, and sellers when they have quoted are reported to have been met by offers. Millowners, as far as can be gathered, are not prepared, however, to accept offers, regarding £13 as the minimum to which they are prepared to go. Some business from South America is reported to have been received at the new low figure, and millowners hope for a revival of buying such as will enable them to advance prices to a more remunerative level. There are works still quoting £13 2s. 6d., and even more, but the amount of new business going to these mills is small. A large number of the sheet mills are now very short of orders, hence this attempt to stimulate buying.

Steel Scrap.

Buying of steel scrap continues slow and prices are unaltered. Works in South Wales are evidently well supplied, and merchants in Birmingham contend that any further lowering of selling values they could possibly make would fail to stimulate demand. They are content to await a revival in consumptive demand.

Bid for Heavy Motor Vehicles Market.

Birmingham is to provide the stage on which will be produced the heavy motor vehicles with which Sir William Morris, of Morris Commercial Cars, Ltd., is to make his bid for the world's markets. Two years ago the Adderley Park, Birmingham works of the Wolseley Motor Company were taken over by Sir William's firm. They have been stripped to the shell and re-equipped with the most modern machinery used in automobile engineering, which will facilitate a huge output on mass production lines. The cost of reconditioning the factory, which covers 28 acres, is said to have exceeded a quarter of a million pounds. What this new enterprise will mean to Birmingham may be to some extent gauged from the fact that it is hoped ultimately to produce 100 vehicles per week, and this would find employment for some 5000 workpeople. It will, also, of course, stimulate the activities of other industries ancillary to the automobile trade. For some years the firm has been making a light form of commercial vehicle on a large scale at Smethwick, but the new effort has reference to heavy vehicles up to 10 tons capacity. The campaign is to be opened with a new luxury coach to accommodate twenty-eight passengers. It will be equipped with a six-cylinder engine developing 110 B.H.P.

Electricity in Birmingham.

The rapid progress which electricity is making in the Birmingham area is clearly shown by the latest trading returns of the City electric supply undertaking. This shows an increase in the quantity of electricity sold during the past three months, compared with the corresponding period of 1928, of nearly 20 per cent. Additional premises to the number of 2950 were coupled to the mains during the same period. These extra consumers represent an addition of 30,600 60-watt lamps in lighting supplies and 8300 H.P. in power supplies, and constitute the largest addition made in any period of three months in the history of the undertaking.

The Late Mr. James Piper.

On October 24th the death occurred of one of the oldest members of the Birmingham Iron and Steel Exchange—Mr. James Piper, of Amblecote. Until a year ago he was a partner in the firm of Lewis, Webb and Co., of Stourbridge, iron, steel and mineral brokers, and was for a long period Treasurer of the Staffordshire Iron and Steel Institute. His membership of the Birmingham Exchange went back beyond the date of its incorporation fifty years ago. As a member of the Committee, and in the wider relations of business, he was held in high esteem.

More Unemployment.

The reduction in the number of unemployed recorded last week has been wiped out, the total having increased since then. The number of unemployed in the Midlands area now stands at 155,054, against 152,890 a week ago and 154,241 a fortnight ago. In the Birmingham area there has been a decline, the figures having fallen from 24,609 to 23,962. At Coventry, Nottingham and Wolverhampton there have been more workers taken on, while in the Stoke-on-Trent area the total unemployed have decreased in number from 15,292 to 13,915. Despite the progress made in these areas, the total for the Midlands, as a whole, shows the substantial increase set out above.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Mechanised Mining Gains Ground.

INTERESTING progress in the use of underground machinery in coal mines in Lancashire and North Wales is indicated in the official report covering the division. Both in coal cutting and conveying plant, last year's figures showed a definite increase compared with 1927. Last year 992 machines were at work in the collieries situated in the division—875 operated by compressed air and 117 electrically driven, or an increase of 18 and a decrease of three respectively on the year. Altogether, these machines were responsible for a coal output of 3,354,000 tons, or 18 per cent. of the total. The expansion was more pronounced, however, in respect of conveying plant, the number increasing from 182 in 1927 to 219 last year, when they conveyed just short of 12 per cent. of the total output. For the third time in the official history of the Lancashire and North Wales division, there were no accidents from explosions, and Mr. A. D. Nicholson, who has recently retired from the divisional inspectorship after thirty-two years' service, attributes much of the credit for this to those responsible for the ventilation and stone-dusting of the mines, especially as many of the mines in the area give off a considerable amount of fire-damp and are frequently very dusty.

Money for Power.

The Electricity Committee of the Manchester Corporation is proposing to spend altogether the sum of £250,000, which includes £250,000 for ordinary mains and £40,000 for the provision of a transformer station in Cumberland-street, Deansgate, Manchester.

The Sale of Steam.

Low-pressure steam has for a number of years been supplied by the Manchester Corporation from its electricity generating station in Dickinson-street to several important buildings in the vicinity, including a theatre, two large warehouses, and a big insurance office, the steam being used mainly for heating purposes. Power to extend the service is being sought by the Electricity Committee, and with this end in view it is proposed to insert a clause in the new Manchester Corporation Bill which it is intended to promote. Up to the present there has been no necessity to secure wayleaves to place pipes under the streets, but the possibility of this having to be done is now envisaged, hence the suggested clause. The official view of the matter is that the time may come when electricity will not be generated at the Dickinson-street station, and that it may be a commercial proposition to utilise the boilers to supply steam for sale.

Iron and Steel.

Conditions in the markets during the greater part of this week have been bordering on dulness, so far as fresh business is concerned. Buying in the case of pig iron has been confined to a relatively few replacement orders, but sellers continue to report a satisfactory flow of specifications for contract deliveries, and little falling away from the recent level of activity in Lancashire foundries is indicated. Prices are fully maintained at 77s. per ton, for both Derbyshire and Staffordshire brands, including delivery equal to Manchester, Scotch iron being quoted at about 93s. and hematite at 90s. per ton. A quiet trade is passing in bar iron, with Lancashire Crown quality quoted at £10 15s. per ton and No. 2 material at £9 15s. The position of constructional engineering concerns locally is less satisfactory. With few exceptions, they are badly in need of work, and prospects are not improved by the prevailing absence of any important volume of inquiry. Conditions in this section have already been reflected in reduced deliveries against contracts. Generally speaking, locomotive engineers are fairly busy, and further additions to work in the hands of two of the leading companies in Lancashire have been announced this week. At the moment they are not buying very much material, though they are reported to be taking satisfactory supplies against existing commitments. The situation of boilermakers is no better than it has been for some time, and steel buying interest from this direction is very slow. Except that the tendency in the case of small re rolled bars seems to be easy, there has been no quotable change in the price position of heavy steel products, and the prospects are for continued firmness, even if no advances are decided upon at next week's meeting of producers. Foreign steel steadily weakens week by week, and semi-finished material, in particular, has reached new low levels, billets being quoted at from £5 4s. to £5 6s. per ton according to size, sheet bars at £5 6s., steel bars at about £6, wire rods at £6 17s. 6d., angles at £6 5s. to £6 10s., and joists at £6 2s. 6d. —delivered to Lancashire buyers' works.

Non-ferrous Metals.

Notwithstanding further slight weakness in the copper and spelter sections of the non-ferrous metals market, the tone generally has been steadier, tin, in particular, following the persistent decline of the past six weeks, having given some indication of improvement. The probability is in the case of tin that the recovery has resulted primarily from a wider demand for the metal, due to renewed confidence among buyers, and for a change there has been a fairly heavy drop in warehouse stocks in this country. Inquiry for copper has shown some contraction, and industrial users of refined descriptions have not been purchasing at all freely. This section of the market has been subject to ups and downs during the week, the net result in the case of standard brands being a decline of from 5s. to 10s. per ton, according to position. At the moment, lead appears to be in the strongest position statistically. There has been a fair demand about, and with offers too plentiful prices have held steadily at about last week's level. With regard to spelter, although prices seem to be more stable, the position is still uncertain, and there has been a further loss on balance of about 2s. 6d. per ton.

Royal Agricultural Society.

A meeting of citizens was held at the Manchester Town Hall on Tuesday last under the chairmanship of the Lord Mayor for the purpose of appointing a Committee and taking other measures in support of the action of the City Council in inviting the Royal Agricultural Society to hold its next summer meeting in Manchester. An excellent site of over 90 acres near Alexandra Park has been obtained, and is now being prepared for the Show.

The last visit of the Society to Manchester was in 1916, when many of the implement makers had much difficulty in making their customary display on account of other and more urgent requirements.

BARROW-IN-FURNESS.

Hematite.

The condition of the hematite pig iron trade continues to be satisfactory, and makers are well fixed for contracts for some months to come; in fact, some customers have covered themselves well into next year. There is a small cloud on the horizon, though, and that is the threat of trouble in the coal-mining industry, for any stoppage would affect the supply of coke, and that would mean serious interference with a run of production which promises to be steady. The home demand for pig iron is good and the foreign trade is well maintained. Special qualities of iron are in good and steady demand. The Millom and Askam Company is proposing to spend the sum of about £20,000 on the overhauling of its furnaces and plant at Millom. This company has had a steady run of production for many months, and its position is stronger to-day than it has been for a considerable time. It is claimed that it shows a lower cost of production than many other firms, owing to up-to-date methods and plant. Its plant at Askam has been idle for many years, all activities being concentrated at the Millom works. Iron ore is in steady demand, and native qualities are in fair demand with outside iron smelters. Foreign ore is about the same. The steel trade is dull and competition for all orders is very keen. Hoops are in good demand on overseas account.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Conditions.

THERE is little sign of a substantial revival of the local steel trade. The acid side is in a state of depression, as the demand for ordinary supplies, for general commercial purposes, continues weak. At the same time, while much slackness is to be found in the city, a fair number of firms are well employed on remunerative work. The making of the large hollow forgings, reported last week, will necessitate the starting-up of one or two additional furnaces to melt the steel, but in other respects the number in operation shows no change. Another order for steel material for the South African railways has been reported during the week. This has been booked by John Brown and Co., Ltd., and is for 2500 locomotive tires, representing a value of £12,000. The amount of work recently placed with the railway material departments will make that company busier than it has been for a considerable time, but this effect will not last long, as the modern plant for making tires is much more expeditious than that which was in use before the war. The reduction of armaments is having an adverse effect on several firms, which are receiving fewer orders for shells, guns, and ship steel. On the other hand, there is a number of busy departments, among them being those which produce stampings and special steels for motor car and aircraft work, cold wrought steel, high-grade wire rods, wire, basic steel, and engineers' small tools. Some improvement is reported in the file trade, while the increasing adoption of central heating for large institutions and factories is also bringing orders to Sheffield.

Steel for Aircraft.

One of the newer branches of Sheffield trade in which expansion may be fairly hoped for is that of aircraft steel. Air-Marshal Sir John Higgins, at the Cutlers' Feast last week, made the interesting remark that steel would become, still more than it is at present, the dominant feature in modern aircraft. Three years ago, he said, nearly all aircraft in the Service, and all the civilian aircraft in Great Britain, were made of wood. In less than three years we had arrived at the position that at least 50 per cent. were made of metal. No more wooden machines were being ordered, and he confidently looked forward to having in another year, or two at the most, nothing but metal aircraft in the service. The same applied to a less extent to civilian aircraft. The large share which Sheffield has had in the development of aircraft was dwelt upon by Mr. Douglas Vickers, when the Master Cutler and his guests visited the Vickers Works on the day after the Feast. One interesting remark which he made was that all the machines which competed for the Schneider Trophy recently—not only the English but the Italian—had in them essential parts which were made at Vickers' Sheffield works. It is, of course, now well-known that the machine which won the trophy was constructed in a works that belongs to the Vickers combination—the Supermarine Works at Southampton.

A Busy Firm.

A firm engaged on the manufacture of railway material and drop stampings which is very busy just now is that of George Turton, Platts, and Co., Ltd., Sheffield. The past year was not as satisfactory as its predecessor, for, the directors state, wagon building was again on a very limited scale, and railways continued their policy of drastic economy. The orders obtained were for much smaller quantities, which increased the cost of production, while selling prices continued to fall. At present, however, the company is well provided with orders, several departments are working night and day, and the prospects for the current year are good. The output for the first two months of the current year has greatly exceeded that for the corresponding two months in 1928, while large numbers of wagons and locomotives are now on tender, specified with the firm's special buffers. It is evident, therefore, that during the next few months the works will be exceedingly busy.

Cutlery and Plate.

The seasonal spurt, in preparation for the Christmas sales, is in full swing in the cutlery and plate trades. Many firms are busily employed, and there is little of the slackness which has been such a general feature during the greater part of the year. At the same time, the improvement is not an all-round one. While the output of stainless table cutlery is on a large scale, there are complaints that a large proportion of it is being sold at unremunerative prices. Scissors are an expanding branch, and much trade in that department, which formerly went to Germany, has now been obtained by Sheffield. There is also continued progress in the trade in safety razor blades, the number of local makers of which has increased lately. The export of these articles is on a substantial scale. The seasonal trade improvement is not so marked in the case of plated hollow-ware, but there is a good demand for small plated wares in cases, spoons, and forks. Makers of sterling silverware are busier than they have been for some years. The low price of raw silver has proved of much advantage to the trade. Increased quantities have been worked up, and retail distributors are being encouraged to acquire larger stocks.

Sheffield Schemes.

In response to the appeal of the Government to hasten the preparation of relief works, Sheffield Corporation drew up a programme of paving, road widening, sewerage, and other improvements, involving a total expenditure of £217,535. It is now announced that these schemes have been practically approved by the different Government departments, and are to be put in hand at once. The Corporation proposals also included one for the construction of the new Burbage Reservoir, on the moors a few miles away from Sheffield. With regard to this matter, the Finance Committee now reports that the Government's contribution has been generously increased beyond what was originally promised, but that the expenditure, if the work were put in hand upon the revised terms of State contribution, would involve, in the course of a few years, a probable increase in the water charges. In view of this fact, and of the anticipation that the watet to be stored by the carrying out of the scheme would nor be required for use for some time, the question of proceeding with the work has been deferred pending further inquiries.

Municipal Projects.

The Mablethorpe and Sutton Urban Council is proposing to carry out large works, including a new drainage scheme and a water supply for Mablethorpe and Trusthorpe, at a total cost of £54,000. When the Ministry of Health approved the drainage scheme, it stipulated that provision for a water supply should also be made, and the Council has accordingly decided to submit a scheme. This part of the programme will cost £27,300. The water will be obtained from Maltby-le-Marsh, three miles away from Mablethorpe, where the Council sank a test bore three years ago, and will be taken to a water tower at Mablethorpe for distribution. At Bridlington the Harbour Commissioners have been informed by the Government that a grant of £7000 will be made towards the improvement of the harbour, including the construction of a new jetty and the widening of the south pier. Bridlington Town Council has decided to construct a new road from Quay-road to Hilderthorpe-road, at a cost of £7082. A scheme for the erection of municipal offices at Bridlington, at an estimated cost of £42,000 has, however, been rejected by the Council.

NORTH OF ENGLAND.

(From our own Correspondent.)

Eliminating Slag Banks.

THE huge slag banks which are an eyesore to most iron and steel producing areas, will, it is claimed, be eliminated as the result of a new process of utilising the waste from the blast-furnaces evolved by Bolckow, Vaughan and Co., Ltd., Middlesbrough. Since the end of the war great inroads have been made in the old slag banks in all parts of the Tees-side area for the purpose of road-making material, and one or two have been worked out. The question of the disposal of this slag was at one time a matter of deep concern to the Tees-side ironmasters. Great banks containing millions of tons of material were built up, and they occupy valuable land which could be used for better purposes. Indeed, they became of such tremendous proportions that ironmasters had to resort to the expedient of sending the slag by specially built hoppers to be dumped into the North Sea, a method of disposal which involved enormous expense. Now, not only are the existing slag banks being heavily drawn upon, but the new process converts the molten slag direct into road material and eliminates the cost of tipping and subsequent working. Slag from the basic blast-furnaces is run into ladles, which take it to casting pans alongside the furnaces, where it is cast into large cakes about 15in. thick. While cooling, the slag anneals itself, and a material almost as hard as granite and impervious to water is secured. The slabs, when cool, are broken and crushed, screened and graded ready for delivery to the road contractor and public authorities. A remarkable feature is that this material is supplied to a definite analysis, and consequently possesses an advantage over material worked from disused slag tips. Bolckow, Vaughan's experiments have attracted great interest among road-making authorities, and during the last few days they have, it is stated, entered into contracts involving the delivery of hundreds of thousands of tons of the new material to road contractors in the London and Home Counties area. This business has been secured at the expense of Belgian producers of road material, and, with the excellent shipping facilities which exist on the Tees, there seems to be every prospect of the new industry developing very satisfactorily.

Iron and Steel Trade Outlook.

An uncertain tone has developed in iron and steel trade circles in the North of England, and business has fallen away to some extent. Consumers are adopting a very cautious policy, and inquiries result in only light transactions, though in certain branches rather considerable purchases have yet to be made to cover requirements up to the end of the year. Producers of nearly all commodities are busy, but in one or two departments orders to follow contracts approaching completion would be very welcome. Though foreign competition is increasingly keen, manufacturers are disinclined to grant price concessions, protesting that production costs, which are high and still rising, prohibit movement in that direction. One or two descriptions of material are unsaleable, except at a loss to makers, and ruling rates for most commodities yield but little profit.

Cleveland Iron Trade.

There is little new of moment in the Cleveland pig iron trade. Production continues to be well taken up, and producers are not hampered by large stocks, but prospect of material enlargement of demand is not bright, and while makers adhere to the minimum fixed quotations, merchants are selling on lower terms. The latter, however, have not a great deal of iron to dispose of. Home consumers are reported to be placing a few orders, but export business is little heard of. No. 1 Cleveland foundry iron is 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

Hematite Pig Iron.

Conditions in the East Coast hematite pig iron trade show no change. Home and continental users are prepared to make small purchases at figures that have been accepted of late, but sellers hesitate to entertain the terms offered, and producers repeat that the advisability of putting furnaces out of action will have to be taken seriously into consideration unless values move quickly towards economic rates. Quotations are still a matter of individual negotiation and consequently vary. Up to 77s. is asked for ordinary qualities, and No. 1 quality is at a premium of 6d. per ton. These prices are at least 3s. below cost, but do not tempt customers to operate.

Ironmaking Materials.

In the foreign ore trade sellers have little to offer, and consumers have long contracts to draw against and are not disposed to open negotiations for forward supplies on terms demanded, the basis of which is fully 24s. 6d. c.i.f. Tees for best Rubio. The acute scarcity of blast-furnace coke is causing much uneasiness. Present supply is much below current needs. Makers are thus in a very strong position, but are anxious to meet the requirements of local users as far as possible, and are not taking advantage of the situation to force up prices. Durham good average qualities are 23s. 9d. delivered to works in the North-East area.

Manufactured Iron and Steel.

In the steel trade makers of semi-steel have to face the competition of cheap foreign steel, but r sing costs preclude price concessions. Home buying of finished steel is on a disappointing scale, but prospect of greater activity at North-East Coast shipyards has had a stimulating influence on branches directly concerned, and producers in other departments look for some improvement of demand. Export business is quiet, but inquiries from certain quarters overseas are stated to be just slightly better. Prices are all very firm.

Steel Order for Tees-side Firm.

The order for the steel work of what will be one of the biggest cinemas in London has been secured by the Tees-side Bridge and Engineering Works, of Middlesbrough. The new cinema, which is to be called the Broadway, and is to be built in New Kent-road, London, will have seating capacity of 3600. Between 1200 and 1400 tons of steel will have to be fabricated in Middlesbrough, and the order will be spread over forty weeks.

The Coal Trade.

The colder weather and a better supply of tonnage have strengthened the coal trade outlook considerably. With this improvement, all sections of the market are healthy. In view of freights being easier and coal prices relatively high, the latest tendency among consumers abroad is to buy sparingly and only for immediate needs. Northumberland collieries are well sold ahead, and quote very firm prices for any odd lots they may be able to offer. Shipments during November promise to be on a large scale. Large and small steam coals are in equally strong demand, and much more coal could be disposed of if it were available. Best Northumberland steams are quoted at 16s. 9d. to 17s., and seconds at 15s. to 15s. 6d. Durham gas coals are much steadier at 16s. 9d. for best qualities, and 15s. to 15s. 3d. for second kinds. The revived inquiry for coking fuel is upheld. The scarcity of blast-furnace coke for home use is rather pronounced, but there is not much likelihood of any more furnaces being re-lighted. The export demand for coke is very good, and the better values are holding out well. Gas coke makers have sold right through November.

SCOTLAND.

(From our own Correspondent.)

Steel.

OWING to various circumstances the tone of the steel trade is dull. One or two branches maintain a fair measure of activity and have comparatively good bookings, but on the whole the outlook is far from bright. Shipbuilding requirements are most disappointing, and the weakness on the Continent affects various branches here. Local steel works maintain a fair rate of output at present, but none views the future with any particular degree of confidence, owing to the unsatisfactory demand for plates and sections alike, along with other commodities.

Steel Sheets.

Sheet makers on the whole experience a moderate demand for their products. Black sheets of the lighter gauges are in better request than the heavier descriptions. Galvanised sheets are improving, and makers anticipate an early increase in turnover for shipment to Eastern consumers.

Tubes.

The demand for tubes is still comparatively good, though now somewhat below the standard set some months ago, when some works had an almost unprecedented run of continuous employment.

Bar Iron.

Bar iron makers are still in need of orders. Special qualities have a fairly regular demand, but ordinary descriptions are poorly supported. Despite increased prices in other districts, local prices remain unchanged. Makers of re-rolled steel bars have a very limited demand for their products. Competition is very keen, and the prices obtained are not always on a remunerative basis. Local prices are as follows :—£7 17s. 6d. for home delivery and £7 15s. per ton for export.

Pig Iron.

Conditions in pig iron also are unchanged. The restricted output is sufficient to meet all demands. Prices are unaltered.

Scrap.

Business in scrap is on moderate lines, and prices continue on an easier basis, as follows :—Heavy steel, 74s. to 75s.; cast iron machinery, 70s.; and heavy basic 70s. per ton.

Coal.

Weather conditions still retard the expansion of the home trade and collieries have not been able to impose the increased charges proposed some time ago. Neither private nor municipal users are taking anything like their usual supplies for this season of the year. Consequently, a considerable amount of fuel is being thrown on the shipping market, though perhaps not in sufficient quantity to have an appreciable effect on prices. Business in export is still practically confined to prompt demands, and the collieries seem to be fairly well supplied with orders. Outputs are quickly disposed of in most cases, though Lothians steams have on occasion some prompt lots available. Lanarkshire splints and ells and Fifeshire steams, more especially the third-class qualities, are all fully taken up at full market prices. Washed nuts, and particularly the larger sizes, continue to provide the feature of the industry. Demands for these for shipment are unusually heavy, and prices, especially of the larger sizes, are very firm. Aggregate shipments amounted to 293,351 tons, compared with 284,958 tons in the preceding week and 257,510 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

The loading pressure in respect of anthracite coals continues to be exceptionally heavy, and steamers are waiting at Swansea to get into berth, but unfortunately the position so far as steam coals are concerned is by no means so satisfactory. In fact, the reverse is the case, inasmuch as there is an excess of idle tipping appliances over the quantity of tonnage available. Still, the shortage of tonnage, while disappointing, is not as bad as it was a few weeks ago, but it means that there is very little life in the steam coal market, and, as a matter of fact, even small coals are not as good as they have been of late. The chartering of tonnage is on a very fair scale, but it is insufficient to impart real strength to steam coals as a whole. New business for prompt shipment displays no material expansion, and, so far as contract operations are concerned, there appears to be no important development. Several inquiries in respect of coals for delivery over the next few months, and over next year as well, are still under negotiation, but the probability is that more business would be possible if the outlook were not so obscure. At the moment of writing, the Government's proposals in relation to working conditions in the coalfield are anxiously awaited, but the feeling prevails that, while the demands of the Miners' Federation will not be met in full, there is the prospect that the Government will decide upon a measure for the reduction of working hours on a piecemeal basis, beginning with a seven and a half hour day, which owners estimate will mean an increase in working costs of 1s. 6d. to 2s. per ton. This extra cost might be modified to some extent if coalowners were permitted to apply the total of forty-five hours per week, which seven and a half hours per day represents, in a way to suit them, viz., eight hours per day for five days of the week and a short shift on the Saturday of five hours.

Non-unionism.

The strike in the Garw district entered upon its third week on Monday last, notwithstanding that it is stated that only a few men have so far declined to join the ranks of the Miners' Federation. The strike is being financed by the South Wales Miners' Federation, the executive of which decided last Saturday to support the men financially. Although nothing official has been disclosed, it is reported that the executive agreed to finance the strike up to the extent of £50,000, which is equivalent to a grant of £10 to each man on strike.

Ebbw Vale Steel Works.

A few weeks ago considerable consternation was caused by the announcement of the closing down of the Ebbw Vale Steel and Ironworks, and it was expected that 5000 men would be affected. Fortunately, the position is not quite so serious, though it is still bad enough. Notices affecting 2000 men took effect during the past week-end, and the position is that, unless fresh orders were received, the steel works blast-furnace plant, with the exception of one furnace and 100 by-product coke ovens, would close down after the morning shift on Wednesday of this week. That would leave the top mill, Siemens furnaces and the sheet mills, together with part of the by-product plant, in operation.

Swansea Dock Facilities.

Reference has been made to the communication which was sent recently by the secretary of the Swansea Chamber of Commerce to the Great Western Railway Company pointing to the need of the company providing increased shipment facilities at Swansea docks. The congestion at the docks has for some time past been very heavy, and those firms which have had steamers loading coal cargoes have had reason for considerable complaint, as, owing to the delays experienced, extremely heavy demurrage bills have had to be faced. The Swansea Chamber of Commerce has also made inquiries as to the loss of trade which Swansea experienced during the month of October by reason of the diversion of tonnage to neighbouring ports, and it is stated that the number of steamers is twenty-seven, with an aggregate coal-carrying capacity of 70,559 tons, exclusive of bunkers. This, it is pointed out, is a serious loss to Swansea docks. Mr. C. S. Page, chief docks manager to the Great Western Railway Company, has written to the Swansea Chamber of Commerce, maintaining that the coal shipping facilities at the port are more than adequate for dealing with the business, but that the position is under review, and, at the present time, the company has under consideration certain proposals for the further improvement of the coal shipping facilities.

Steel and Tin-plate Trade Wages.

Steel workers in West Wales will benefit to a slight extent as the result of the quarterly steel bar ascertainment for the three months ended September 30th. The audit, which shows an average price for the quarter of £6 2s. 2·95d. per ton f.o.r. makers' works, governs wages from November 3rd to February 3rd next, and is equivalent to 10 per cent. under the sliding scale or 1¼ per cent. in excess of the previous ascertainment. It is stated that the question of certain *ex-gratia* bonuses, which are now in operation, being continued will be discussed by the Siemens Steel Association and the Iron and Steel Trades' Confederation. In the case of the tin-plate industry the sliding scale agreement enters into its second quarter under the new arrangement on Sunday, November 3rd. Under the scale, zero was based upon the ascertainment for the three months ended June 30th, so that in the current quarter no percentage has been paid under the agreement except *ex-gratia* bonuses. The ascertainment for the quarter ended September 30th has now been received, but shows no perceptible alteration, so that no percentage will operate for the next quarter, which commences on November 3rd and runs to February 3rd. The ascertainment is now based on the price of tin-plates, after deduction of costs of tin and steel bars.

Notices to Steel Workers.

Men engaged at the Briton Ferry Steel Works and the Albion Steel Works, Briton Ferry, numbering about 1000, have received notices that their contracts will terminate at the end of November. This step has become necessary by trade depression.

Works Re-opening.

Unemployment at Port Talbot will be reduced this week by the resumption of work at the Crown Patent Fuel Works, Taibach, and the old siding of the Port Talbot Steel Works. At the fuel works agreement has been come to with the men to work on the two shifts per day principle instead of three. Work for 200 men will be provided. The restarting of the old siding of the Port Talbot Steel Works is expected to provide work for at least 300 steel workers.

Newport and Reservoir Scheme.

The Newport Corporation has decided to start at once on the construction of a dam and reservoir at Talybont, costing £500,000, this being the final stage in the scheme which was initiated about seven or eight years ago. The Government has accepted the construction of the reservoir as an unemployment relief scheme, and, as a result, the ratepayers of Newport will be relieved of about £200,000 of the total expenditure. It is estimated that the work provided will benefit several hundred men for a period of from six and a half years to eight years.

Current Business.

The tone of the anthracite coal market is firm all round, but in the case of steam coals the conditions are comparatively quiet. At the end of last week there were thirty-seven idle tipping appliances at the various docks, and unfortunately arrivals of tonnage over the week-end have been disappointing, as on Monday there were still about twenty-five appliances not in operation, which means that the outlet for coals was very restricted. Large coals are in excessive supply and even smalls are not so steady. Coke and patent fuel maintain a good tone, but pitwood is quiet, though without any appreciable change in price.

The Institute of Marine Engineers.—The Council calls attention to the numerous awards which it offers annually for competition. These awards will be granted to the authors of papers or essays presented to the Institute during the session, provided they are deemed of sufficient merit. The Institute has also full particulars of the Lloyd's Register Scholarship and Student Graduate Examinations which are conducted annually under its auspices. Full particulars can be obtained from the Secretary at 85–88, The Minories, E.C. 3.

ACID-RESISTING STEELS FOR CHEMICAL PLANTS.

An interesting lecture was given by Dr. W. H. Hatfield, of the Brown-Firth Research Laboratories, Sheffield, on October 25th, at the Institution of Civil Engineers, London, under the auspices of the Institution of Chemical Engineers, on "The Fabrication of Acid-Resisting Steel Plant." The first portion of Dr. Hatfield's lecture was devoted to the scientific aspects of the gradual evolution of these special materials, and he then proceeded to discuss various technical difficulties which had necessarily to be overcome before the new steels could take their useful place in industry. At the close of the lecture, he exhibited a film illustrating not only the production of the steel, but the fabrication of large items of plant, which are now being utilised in some of the biggest chemical works in the world.

In the course of his lecture, Dr. Hatfield said that it was the development of the rich chromium-nickel steels which led to the present great development, and stated that it was the contents of a scientific treatise recording the results of experiments conducted at the Brown-Firth Research Laboratories on the response of steels of various compositions to certain acids in 1923, which led to a visit of important officials of the Imperial Chemical Industries, Ltd., to the Firth works, as a result of which the firm undertook the casting of large quantities of ingots weighing over 4 tons each and rolled them, with the collaboration of the Park Gate Iron and Steel Company, into the largest sizes of plates. This made practicable the construction of very large plant at Billingham. For the first time a huge chemical plant was manufactured from these special steels, and subsequently German and American chemical works followed suit.

Dr. Hatfield stated that the technology of these special steels had now been brought to such a high state of efficiency, and the economic aspects were so completely in hand, that there must inevitably be a vast extension of their use.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

William Asquith, Ltd., of Halifax, asks us to announce that Mr. G. Varley, A.M. Inst. C.E., M.I. Mech. E., A.M.I.E.E., and Mr. T. Lockwood Bunce, M.I. Mech. E., have joined the staff of the company.

G. and T. Earle, Ltd., of Wilmington, Hull, ask us to announce the fact that the style of the company has been altered from G. and T. Earle (1925), Ltd., to G. and T. Earle, Ltd., *i.e.*, the 1925 has been deleted.

Daniel Adamson and Co., Ltd., of Dukinfield, ask us to announce that they have purchased the goodwill and drawings of Messrs. J. Carmichael and Co., boilermakers and specialists in steel plate works, of Ward Foundry, Dundee.

Mr. P. J. Pybus, having observed that some recent notices in the Press have referred to him incorrectly as either managing director or chairman of the English Electric Company, Ltd., desires us to explain that his position in the company is that of director.

Marshall, Sons and Co., Ltd., of Gainsborough, ask us to announce that Mr. Arthur Colegate has joined the board of directors and has been appointed a managing director of the company, to act in conjunction with the chairman and managing director, Major H. D. Marshall.

Steatite and Porcelain Products, Ltd., requests us to announce that in future all inquiries and correspondence should, in order to receive prompt attention, be addressed to it at Bewdley-road, Stourport, Worcs. Telephone, Stourport 111; telegrams, "Steatain, Stourport."

R. A. Lister and Co., Ltd., of Dursley, ask us to announce that, in order to assist their customers in the solution of their water and pump problems, they have instituted a pump service department, the object of which is to provide expert advice on all matters connected with pumps and their installation. No charge will be made for the service.

Wailes Dove Bitumastic, Ltd., of Newcastle-on-Tyne, asks us to announce that, in view of the fact that in many instances indiscriminate use of its trade mark "Bitumastic" has been made by unauthorised persons, it will, in future, should similar cases of such misuse be brought to its notice, seriously consider the taking of drastic action against the offenders.

CONTRACTS.

John Brown and Co., Ltd., in addition to the large order for tires and axles announced last week, has received a further order for 2500 locomotive tires for the South African Railways. The value of the latest order is over £12,000.

The Royal Naval Divisional Engineers will hold their annual dinner at the London Tavern, Fenchurch-street, E.C., on Friday, November 15th, at 6.30 p.m. for 7 p.m. No evening dress. Tickets, price 5s. 6d., may be obtained from Mr. F. W. Davey, 14, Victoria-street, S.W. 1; or Mr. Eric Wettern, St. Stephen's House, Westminster, S.W. 1; or at the Restaurant.

Streatfield Memorial Lecture—Finsbury Old Students.—The subject of the Streatfield Memorial Lecture this year is "The World's Sugar Industry." It will be delivered by Mr. Lewis Eynon, B.Sc., F.I.C., at the Institute of Chemistry, on November 22nd. Tickets can be obtained from the Hon. Secretary, Finsbury Old Students' Association, F. R. C. Rouse, 15, Clifton-gardens, Golders Green, N.W. 11.

Whitworth Scholarship.—The Board of Education has published the following list of awards of Whitworth Scholarships as the result of this year's examination :—Awarded Senior Scholarships of an annual value of £250, tenable for two years : John G. Jagger, 22, student, late engineer apprentice, Manchester (Manchester University); and John Caldwell, 23, student, late engineer fitter, Greenock (Glasgow Royal Technical College). Awarded Scholarships of an annual value of £125, tenable for three years : John W. H. Freebody, 19, electrical fitter apprentice, H.M. Dockyard, Portsmouth (Portsmouth H.M. Dockyard School); Alfred F. Barnes, 19, apprentice, H.M. Dockyard, Devonport (Devonport, H.M. Dockyard School); Robert F. Beaton, 19, electrical fitter apprentice, H.M. Dockyard, Portsmouth (Portsmouth, H.M. Dockyard School); Walter W. R. Beer, 19, apprentice, H.M. Dockyard, Devonport (Devonport, H.M. Dockyard School); Dudley H. New, 21, fitter, Swindon (Swindon, The College); Leslie B. Cook, 21, engineer apprentice, Manchester (Manchester College of Technology) (this candidate was unable to accept a Whitworth Scholarship and was awarded a Whitworth Prize of £10); and Wm. J. Morcom, 19, apprentice, H.M. Dockyard, Devonport (Devonport, H.M. Dockyard School).

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	19/6 to 22/-
(1) Spanish	24/- to 26/-
(1) N. African	24/- to 26/-
N.E. Coast—	
Native	18/- to 21/-
Foreign (c.i.f.)	24/9

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	4 0 0	—
No. 1 Foundry	3 18 6	—
No. 3 Foundry	3 16 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 17 0	3 17 0
No. 1	3 17 6	3 17 6
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
Midlands—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge		—
„ „ Foundry	—	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 7 6 (*a*) / 4 9 6 (*b*) / 4 13 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
Lancs.—		
Crown Bars	10 15 0	—
Second Quality Bars	9 15 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	10 0 0 to 10 10 0	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ¼in. and up	8 12 6	7 12 6
Sections	8 2 6	7 2 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	13 10 0	13 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 12 6	—
Angles	8 2 6	—
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 2 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
Manchester—		
Bars (Round)	9 2 6	—
„ (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 17 6	—
Sheffield—		
Siemens Acid Billets	9 10 0	—
Hard Basic	9 2 6 and 9 12 6	
Intermediate Basic	7 12 6 and 8 2 6	
Soft Basic	7 0 0	
Hoops	9 15 0 to 10 5 0	
Soft Wire Rods	8 2 6	
Midlands—		
Small Rolled Bars	8 2 6 to 8 15 0	
Billets and Sheet Bars	6 7 6 to 6 12 6	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	13 0 0 to 13 5 0	
Angles	8 2 6	
Joists	8 2 6	
Tees	9 2 6	
Bridge and Tank Plates	8 17 6	
Boiler Plates	9 12 6	

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/9 to 19/-
Block Tin (cash)	184 5 0
„ (three months)	188 5 0
Copper (cash)	71 5 0
„ (three months)	71 5 0
Spanish Lead (cash)	22 17 6
„ „ (three months)	22 15 0
Spelter (cash)	22 0 0
„ (three months)	22 7 6
Manchester—	
Copper, Best Selected Ingots	77 0 0
„ Electrolytic	85 0 0
„ Strong Sheets	110 0 0
„ Tubes (Basis Price), lb.	0 1 3
Brass Tubes (Basis Price), lb.	0 1 1
„ Condenser, lb.	0 1 3
Lead, English	24 2 6
„ Foreign	22 12 6
Spelter	22 10 0
Aluminium (per ton—raw in ot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit
Tungsten Metal Powder	3/6½ per lb.	
Ferro Tungsten	3/3½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
„ „ 6 p.c. to 8 p.c.	£22 0 0	6/6
„ „ 8 p.c. to 10 p.c.	£21 10 0	6/-
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 0 0	10/-
„ „ „ 1 p.c. carbon	£38 10 0	15/-
„ „ „ 0·70 p.c. carbon	£40 0 0	15/-
„ „ „ carbon free	1/2 per lb.	
Metallic Chromium	2/6 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home; £13 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 15 0 scale 5/- per unit	
„ „ 75 p.c.	£19 0 0 scale 7/- per unit	
„ Vanadium	13/- per lb.	
„ Molybdenum	4/- per lb.	
„ Titanium (carbon free)	11d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/4 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	14/-
„ „ Ell	16/-
„ „ Splint	16/9 to 18/-
„ „ Trebles	16/- to 16/6
„ „ Doubles	16/-
„ „ Singles	13/6 to 14/-
Ayrshire—	
(f.o.b. Ports)—Steam	14/6
„ „ Jewel	16/-
„ „ Trebles	17/6
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	13/6 to 15/6
Screened Navigation	17/6 t 18/6
Trebles	18/- to 18/6
Doubles	16/6
Singles	14/6 to 15/-
Lothians—	
(f.o.b. Leith)—Best Steam	14/-
Secondary Steam	13/6
Trebles	17/6
Doubles	16/-
Singles	14/-

ENGLAND.

(3) N.W. Coast—	
Steams	21/6 to 22/-
Household	38/- to 51/-
Coke	27/6
Northumberland—	
Best Steams	16/9 to 17/-
Second Steams	15/6 to 16/-
Steam Smalls	10/- to 10/6
Unscreened	13/- to 13/6
Household	25/- to 37/-
Durham—	
Best Gas	16/6 to 16/9
Second	15/- to 15/3
Household	25/- to 37/-
Foundry Coke	25/- to 30/-
Sheffield—	Inland.
Best Hand-picked Branch	26/6 to 28/-
Derbyshire Best Bright House	21/- to 23/-
Best House Coal	20/6 to 21/6
Screened House Coal	18/6 to 20/-
„ „ Nuts	16/6 to 18/-
Yorkshire Hards	15/6 to 17/-
Derbyshire Hards	15/6 to 17/-
Rough Slacks	9/- to 10/-
Nutty Slacks	7/- to 8/-
Smalls	3/- to 5/-
Blast-furnace Coke (Inland)	14/6 at ovens
Furnace and Foundry Coke (Export), f.o.b.	23/- to 24/-

(9) SOUTH WALES.

Cardiff—	
Steam Coals:	
Best Smokeless Large	20/- to 20/3
Second Smokeless Large	18/9 to 20/-
Best Dry Large	19/3 to 19/6
Ordinary Dry Large	18/- to 19/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	17/9 to 18/-
Best Eastern Valley Large	17/9 to 18/3
Ordinary Eastern Valley Large	17/6 to 17/9
Best Steam Smalls	14/3 to 14/6
Ordinary Smalls	13/- to 14/-
Washed Nuts	19/6 to 30/-
No. 3 Rhondda Large	20/3 to 21/-
„ „ Smalls	15/6 to 16/-
No. 2 „ Large	17/3 to 17/6
„ „ Through	15/6 to 16/6
„ „ Smalls	14/3 to 14/9
Foundry Coke (Export)	32/6 to 37/6
Furnace Coke (Export)	30/- to 31/-
Patent Fuel	22/- to 22/6
Pitwood (ex ship)	28/- to 28/6
Swansea—	
Anthracite Coals:	
Best Big Vein Large	35/- to 37/6
Seconds	28/6 to 30/6
Red Vein	24/- to 27/6
Machine-made Cobbles	42/- to 45/-
Nuts	40/- to 45/-
Beans	24/- to 26/-
Peas	19/6 to 20/-
Breaker Duff	10/- to 10/3
Rubbly Culm	11/6 to 12/6
Steam Coals:	
Large	18/- to 19/-
Seconds	17/- to 18/-
Smalls	12/- to 13/9
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge and Tank Plates and Sections, 10/- if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Steel Production.

A DECLINE of the steel output on the Continent is an inevitable consequence of the feeling which is fairly general that something must be done to put the steel trade on a firmer basis. In September the German production declined, as compared with the monthly average, by more than 200,000 tons. There was a falling off in Belgium of something like 20,000 tons. The French output has undergone little change because steelmakers have to supply a large home demand and are, for the moment, little affected by the difficulty of doing business abroad. The Germans have reduced rolled iron prices for export, and the Belgians hope to resist the downward movement in their own market by organising a central sales office for girders and some other products. If successful it will be extended to other classes of rolled iron and steel. Apart from the smaller foreign consumption there is an element of weakness in the failure of German steelmakers to reconstitute their unions preparatory to the renewal of the Steel Cartel. It is believed that the difficulties which are retarding negotiations will be overcome. As, however, those difficulties are due largely to the dissatisfaction of German steelmakers at not being accorded a larger quota of production, the renewal of the Steel Cartel appears to depend upon the willingness of France to concede the claims of Germany and Belgium.

A New Motor Fuel.

Some rather curious claims were made by Monsieur A. Charles-Roux at the annual Congress of Industrial Chemistry, held recently at Barcelona, when he stated that he had obtained encouraging results with the injection of pulverised carbon in internal combustion engines. He had even made a long tour in a motor car running on pulverised carbon. Monsieur Charles-Roux is a well-known chemist who has done much valuable research work and his tests may be regarded as perfectly sound. The cost of the fuel was, he says, 35 centimes per horse-power hour, as compared with 50 centimes for charcoal suction gas and from 90 centimes to a franc for petrol. The pulverised fuel was only beaten on the score of price by heavy oils. Monsieur Charles-Roux expressed his conviction that charcoal suction gas plants on industrial vehicles would be completely ousted by the injection of pulverised coal in internal-combustion engines. Apparently, the experiments were carried out with a pure form of carbon. There may be a long step between these tests and the use of pulverised coal in internal-combustion engines, but Monsieur Charles-Roux appears convinced that something may be done in this direction, and he declared at the Congress that internal-combustion engines would eventually run on pulverised low grade solid fuels, when the problem of fuel supplies would be entirely solved.

The Turbine Centenary.

Another centenary is in prospect for 1930. It is proposed to celebrate the invention of the hydraulic turbine by Benoit Fourneyron, who, despite the fact that the only material at his disposal was cast iron, produced turbines that rendered good service down to within recent times. It is intended to associate with him in the celebrations the name of Marcel Desprez, who, in the latter half of the century, did so much for the development of long distance electrical transmission, whereby a commercial value was given to the hydraulic turbine.

Hull Forms.

An idea for improving the forms of hulls is suggested in a communication which Monsieur Rateau presented to the Académie des Sciences on behalf of Messieurs Magnan and Sainte-Laguë, who had carried out experiments to demonstrate the resistance offered to fishes at various speeds. Synchronised cinematographic views of fishes were taken, some loaded in such a way that they sank in the tank by their own weight, and it was found that the resistance was the same at all speeds and did not increase in proportion to the square of the speed, except in the case of fishes of special form, such as the skate. They attribute this constant resistance to the perfect streamline form of the fishes whereby there is no eddying of the water. It is stated that a more complete study of these forms may be of interest in the designing of hulls, especially those of submarines.

Foreign Trade.

The home demand for all descriptions ofproducts continues to provide makers with employment, but there is not quite so much briskness as was experienced a few months ago. Higher wages and living costs and taxation have checked the activity, and the future depends largely upon the execution of public works, which probably, in many cases, will have to be slowed down. Therefore, the continuous decline of foreign trade is beginning to be regarded in a more serious light. During the first nine months of the year the import values totalled 43,959 million francs, an increase of 5288 million francs as compared with the corresponding period of last year. The exports were valued at 37,022 million francs, a decline of 530 million francs. As regards quantities the imports during the nine months amounted to 43,945,347 million tons, an increase of 7,829,453 tons, this being due largely to an augmentation of coal imports, which rose from 17,943,125 tons to 22,393,878 tons. The exports totalled 29,873,473 tons, a decline of 1,202,756 tons. This declension was caused almost entirely by the smaller consignments of "material necessary for industry," and while the 4,006,689 tons of manufactured goods exported showed an increase of 70,820 tons, there was a decline in value of 290 million francs. The French are so fully aware of the necessity of doing something to retrieve foreign trade that they are taking an active part in conferences held abroad to discuss remedies. The proposal for a two years' "tariff holiday," which is to be the beginning of a general economic reorganisation, is supported officially, but it is strongly objected to by many industries that are not regarded as sufficiently protected.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

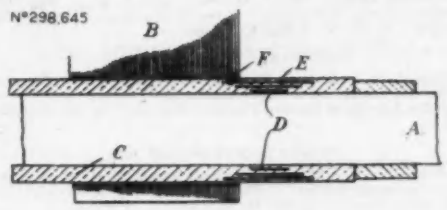
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

298,645. October 12th, 1928.—CORONA ON THE SLOT SLEEVES OF HIGH-TENSION ELECTRIC MACHINES, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

Several arrangements have been proposed for the purpose of preventing the formation of the corona on high-tension electric machines, caused by the arcing over on the slot sleeves. According to this invention, the winding A arranged in a slot of the stator iron B of a high-tension machine, is surrounded by the insulating sleeve C, which is provided at the point where it

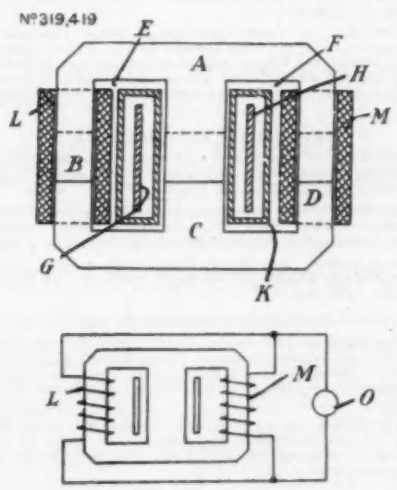


leaves the iron body, with several conductive coatings D, the length of which decreases towards the inside. The coating E lying next to the outside of the sleeve, which has the greatest length, is conductively connected at F to the iron body B, and may, as shown in the drawing, be surrounded by another insulating layer; but it may also be arranged free on the upper surface of the sleeve. The thickness of the insulating layers between the coatings may be the same, or preferably it may increase towards the inside.—*September 26th*, 1929.

TRANSFORMERS AND CONVERTERS.

319,419. June 26th, 1928.—PROTECTIVE GEAR FOR ALTERNATING CURRENT ELECTRIC SYSTEMS, John Harold Buchanan, of "Carnethy," Moss-lane, Timperley, Cheshire, and the Metropolitan-Vickers Electrical Company, Ltd., of 4, Central-buildings, Westminster.

This invention relates to protective gear for alternating-current electric systems in which split conductors are used. The current transforming device described in this specification comprises a core A having three limbs B, C and D, and two windows E and F. The core A is made up in the ordinary manner of E-shaped stampings superimposed one upon another with the joints staggered. The two splits G and H of the split conductor to be protected are respectively passed through the windows



E and F in the core A, and are surrounded by insulating sleeves or tubes K. Two equal secondary windings L and M are wound about the outer limbs B and D of the core A, and are insulated therefrom. The two secondary windings L and M are connected in series with one another, as indicated. A protective relay O is differentially connected with the two secondary windings L and M. When equal currents are flowing through the splits G and H equal currents will be set up in the secondary windings L and M, and no current will flow through the relay O. If, on the other hand, the currents in the splits are unequal, the secondary currents induced in the secondary windings L and M will also be unequal and the difference between the two secondary currents will pass through the relay O, and if sufficiently large, will cause operation of the relay.—*September 26th*, 1929.

BATTERIES AND ACCUMULATORS.

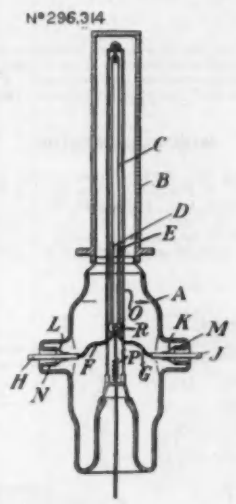
296,990. September 6th, 1928.—SECONDARY ELECTRIC CELLS, Alexandru Sismanopol, of the firm "Forta" Intreprinderi Electro-Mecanice, of Strada C. A. Rosetti, No. 3, Bucharest, Roumania.

In a secondary cell made according to this invention, the negative electrode consists of lead coated with electrically-deposited copper and the positive electrode of peroxide of lead, the active surface of the negative electrode being less than one-half that of the positive electrode and the two electrodes being disposed in a container in such a manner that the negative electrode extends to the bottom, while the positive electrode is supported above. The positive electrode is supported on an insulating base member, so that its lower end is raised above the bottom of the cell or container. The negative electrode extends below the lower end of the positive electrode to the bottom of the cell or container, so as to reduce to a minimum the possibility of internal short circuiting. A cell made in accordance with this invention is claimed to have a low internal resistance, and an initial electromotive force of 1·42 volts. The electrolyte is sulphuric acid.—*September 26th*, 1929.

ELECTRICAL APPLIANCES.

296,314. August 27th, 1928.—ELECTRIC DISCHARGE DEVICES, Siemens and Halske Aktiengesellschaft, of Siemensstadt, Berlin, Germany.

The electric discharge device described in this specification has a cathode of large current carrying capacity and an improved lead-in arrangement for the cathode. The device comprises a glass portion A and a metal portion B which forms the anode. The filament or cathode C is carried upon substantially rigid conductors D and E which are connected by flexible conductors

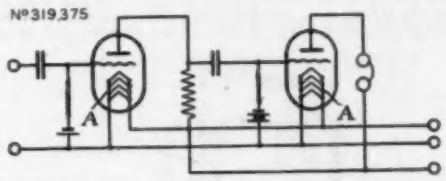


F and G to the conducting rods H and J which constitute the cathode leads-in and pass through the glass wall. The conducting rods H and J are fixed in position in the usual manner by means of metallic intermediate portions K and L, so as to pass through two opposite projecting portions M and N of the glass wall, the rods being perpendicular to the axis of the lamp. O is the grid and P a spring for tensioning the filament, the tension being applied through a member R mechanically connected to the rigid conductors D E.—*October 3rd*, 1929.

TELEGRAPHS AND TELEPHONES.

319,375. March 19th, 1928.—RESISTANCE-COUPLED AMPLIFIERS, *Stanley Gordon Sinclair Dicker, of 20 to 23, Holborn, London, E.C.* 1.

A drawback of resistance-coupled amplifiers is that the amplification factor is less than in transformer coupled amplifiers. To compensate for this difference it is advisable to use valves having a high amplification factor. If in such a valve a correspondingly high plate voltage is used, the effective voltage of

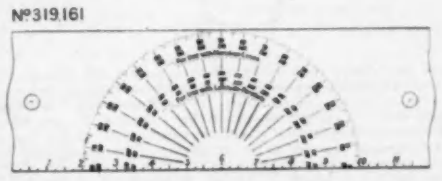


the grid surface will be about 1 volt. When the filament voltage is more than 1 volt, only part of the filament will be able to send electrons in the direction of the grid, because it is essential that the grid be connected to the negative pole of the filament supply source. According to the invention, a resistance coupled amplifier comprises a known type of valve with an incandescent cathode consisting of two or more parallel wires A, each of which is intended for a maximum filament tension of 1 volt.—*September 19th*, 1929.

MEASURING AND TESTING INSTRUMENTS.

319,161. November 14th, 1928.—PROTRACTORS, J. D. White, 43, Barton-court, Chelsea, London.

This protractor is intended for use, in laying out courses, in connection with a compass divided in degrees. It is described as "A transparent protractor having a graduated semi-circle with the diameter base in line with or parallel to a long-edge of the



protractor, the graduated semi-circle having four sets of numberings, all anti-clockwise, the two which are intended for use with meridian lines being numbered from 0 deg. to 180 deg. and from 180 deg. to 360 deg. respectively, and the other two which are intended for use with latitude parallels being numbered from 90 deg. to 270 deg. and from 270 deg. through 360 deg. or 0 deg. to 90 deg." The drawing shows the arrangement of the markings, which may be repeated along the length of a strip.—*September 19th*, 1929.

LOCOMOTIVES.

319,094. July 13th, 1928.—FUEL BUNKERS, Beyer, Peacock and Co., Ltd., Gorton Foundry, Manchester, and R. H. Whitlegg, Woodend, Disley, Cheshire.

The inventors propose to use an inclined conical container for

the coal used on a locomotive and to rotate it by hand or otherwise to feed the coal forward towards the firing plate. The cone is provided with doors for filling purposes, and these doors are

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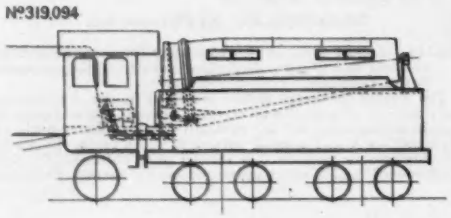

so arranged that they form a hopper or chute when opened. At the front end of the cone there is a fixed casting which leads the coal to a conveyor that feeds the furnace. A pulveriser may be associated with the conveyor.—*September* 19*th*, 1929.

MISCELLANEOUS.

319,178. February 6th, 1929.—Forehearths of Glass Melting Tanks, C. H. Rankin and the Rankin Automatic Glass Feeder Company, Ltd., Fishergate, York.

This invention is concerned with the forehearth of a glass melting tank used to feed a rotary bottle-making machine. In order to ensure a uniform temperature of the glass picked up by

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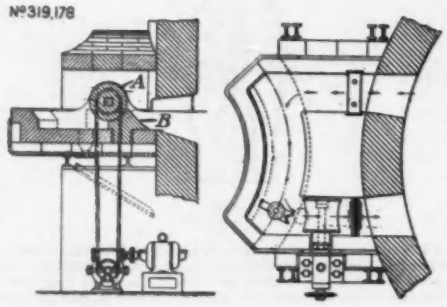

the machine a stream of glass is circulated through the forehearth and the tank by means of the roll A. This roll is rotated clockwise by the motor and gearing shown and carries over the molten glass, which is scraped off by the weir B. The roll and weir are, of course, made of refractory material.—*September* 19*th*, 1929.

319,305. June 20th, 1928.—Mercury Arc Rectifiers, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, and Frank Percy Whitaker, of 237, Clifton-road, Rugby.

The invention consists in providing an anode for a mercury vapour rectifier of approximately inverted pear shape, the anode being provided with an insulated anode shield secured above its upper or larger end and extending downwards a considerable distance below its point or lower end. In close proximity to the anode and within the shield is mounted a series of truncated cones, which are supported from the anode shield. With this arrangement the tendency to arc-back is reduced. The accompanying drawing illustrates a typical form of the invention. A is the

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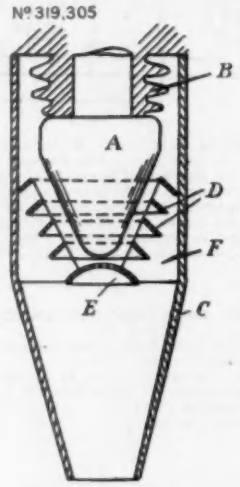

anode of inverted pear shape, which is introduced through the wall of the vacuum chamber of the rectifier through the insulator B. C is the anode shield, of approximately cylindrical shape, which may be carried on the insulator B and which surrounds the wide end of the anode closely. Access for the arc to the tapered portion of the anode face is given through the spaces between the truncated metal cones D. A plate E prevents the direct access of the arc to the point of the anode. Radial metal plates F support D and E from the anode shield C. The best proportions are determined by experiment, but generally the distance from the anode surface to the truncated cones, and the distance between adjacent cones, are both approximately of the order of an inch.—*September* 20*th*, 1929.

The Chartered Institute of Patent Agents.—The intermediate and final examinations prescribed by the Board of Trade under the Register of Patent Agents Rules, 1920 and 1926, will be held by the Chartered Institute of Patent Agents, at Staple Inn Buildings, London, W.C. 1, in April next. Further particulars will be found among the official notices in the *Illustrated Official Journal* (*Patents*) or can be obtained from the Registrar.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

Diesel Engine Users' Association.—Caxton Hall, Westminster, S.W. 1. "Modern Engineering Cast Irons and their Properties," by Mr. J. G. Pearce. 3.30 p.m.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, London, W.C. 2. Meter and Instrument Section Meeting. Chairman's address by Mr. E. W. Hill, 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London. Thomas Hawksley Lecture, "Critical Relations Between Water and Steam," by Professor H. L. Callendar, F.R.S. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Informal meeting. Film, "The Age of Speed." 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne.—"The Development and Performance of the Richardsons-Westgarth Oil Engine," by Mr. W. S. Burn. 6 p.m.

SATURDAY, NOVEMBER 2nd.

Institute of British Foundrymen: Lancashire Branch.—At the College of Technology, Sackville-street, Manchester. "Some Aspects of Modern Foundry Practice," by Mr. Griffiths. 4 p.m.

MONDAY, NOVEMBER 4th.

Bradford Engineering Society.—In the Hall of the Bradford Technical College. "The How and Why of Aviation and Aeroplane Design," by Mr. H. G. Mitchell. 7.30 p.m.

Railway Club.—57, Fetter-lane, London, E.C. 4. "The Highland Section of the L.M.S.R.," by Mr. H. A. Vallance. Lantern slides. 7.30 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, W. 1. General meeting. 5 p.m.

Society of Engineers.—In the Apartments of the Geological Society, Burlington House, W. (East end of the building in Piccadilly). "Land Drainage," by Mr. Gerald A. Wright. 6 p.m.

Wolverhampton and District Engineering Society.—Victoria Hotel, Wolverhampton. "Heavy Engineering Work," by Mr. F. G. Smith. 7.30 p.m.

TUESDAY, NOVEMBER 5th.

Co-ordinating Committee Representing Staffordshire Iron and Steel Institute, Birmingham Metallurgical Society (Inc.), Birmingham Local Section of the Institute of Metals.—At the Girls' High School, Dudley. "Progress in the Metallurgy and Utilisation of Wrought Iron," by Colonel J. S. Trinham. 7 p.m.

Institution of Automobile Engineers.—Joint meeting with Iron and Steel Institute, at the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Steels for Automobiles and Aeroplanes," by Dr. W. H. Hatfield. 7.45 p.m.

Institution of Automobile Engineers.—Broadway Café, Coventry. Birmingham and Coventry Graduates, joint meeting. Discussion, "That Mass Production is Detrimental to the Industry." 7.15 p.m.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Presentation of the Kelvin Medal to His Excellency the French Ambassador on behalf of Monsieur André Blondel, whose health will not permit him to travel to London. 5 p.m. Presidential Address by Mr. W. W. Grierson. 6 p.m.

WEDNESDAY, NOVEMBER 6th.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C. Wireless Section meeting. Chairman's address, by Captain C. E. Kennedy-Purvis. 6 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—Bolbec Hall, Newcastle-upon-Tyne. Graduate Section. Address by Mr. H. A. Morham, Chairman. 7.15 p.m.

Royal Society of Arts.—John-street, Adelphi, W.C. 2. "Fifty Years of Electrical Science and Industry," by Mr. L. B. Atkinson. 8.30 p.m.

THURSDAY, NOVEMBER 7th.

Institution of Electrical Engineers.—In the Lecture Theatre of the Institution, Savoy-place, Victoria Embankment, W.C. 2. "The Analysis and Measurement of the Noise Emitted by Machinery," by Mr. B. A. G. Churcher and Mr. A. J. King, B.Sc. Tech. 6 p.m.

Royal Aeronautical Society.—Lecture Hall of the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Recent Developments of Fuels and Dopes for Aircraft Engines," by Dr. A. E. Dunstan. 6.30 p.m.

FRIDAY, NOVEMBER 8th.

Illuminating Engineering Society.—32, Victoria-street, London, S.W. 1. "Modern Incandescent Lighting in Kinema Studios," by Messrs. W. H. Villiers and S. G. Double. 7 p.m.

Institute of Metals: Sheffield Local Section.—In the Non-ferrous Section of the Applied Science Department of the University, St. George's-square, Sheffield. "Nickel Silver," by Mr. F. Orme. 7.30 p.m.

Institution of Locomotive Engineers (London): Manchester Centre.—In the building of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. "Undue Compression in the Cylinders of Steam Locomotives and Means for Combating Same," by Mr. E. M. Cass. 7 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Annual General Meeting. 7.30 p.m.

MONDAY, NOVEMBER 11th.

Institute of Metals: Scottish Local Section.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Some Difficulties in Aluminium Alloy Founding, and Some Remedies," by Mr. George Mortimer. 7.30 p.m.

Institution of Automobile Engineers.—Queen's Hotel, Birmingham. "Steels for Automobiles and Aeroplanes," by Dr. W. H. Hatfield. 7 p.m.

Institution of Electrical Engineers: South Midland Centre.—At the University, Edmund-street, Birmingham. "Voltage Control of Large Alternators," by Mr. H. W. T. Taylor. 7 p.m.

TUESDAY, NOVEMBER 12th.

Institute of British Foundrymen: Lancashire Branch, Burnley Section.—In the Municipal College, Ormerod-road, Burnley. "A Comprehensive Paper," by Mr. E. Flower. 7.15 p.m.

Institute of Marine Engineers.—85–88, The Minories, London, E.C. 3. "The Opposed-piston Oil Engine," by Mr. J. Harbottle. 6.30 p.m.

Institute of Metals: North-East Coast Local Section.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Age-hardening in Alloys," by Dr. Robert Hay, Ph.D., B.Sc. 7.30 p.m.

WEDNESDAY, NOVEMBER 13th.

Institute of Metals: Swansea Local Section.—In the Thomas Café, High-street, Swansea. "The Effect of Some Impurities in Copper," by Mr. W. E. Prytherch. 7 p.m.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. "New Developments in Hydraulic Pneumatic Engineering," by Mr. J. O. Boving. 8 p.m.

WEDNESDAY AND THURSDAY, NOVEMBER 13th and 14th.

Institution of Gas Engineers.—At the Institution of Electrical Engineers, Victoria Embankment, W.C. 2. Autumn meeting. Wednesday, at 11 a.m., Charter By-laws; Supplementary Report to the Twenty-third Report of the Joint Research Committee of the Institution and Leeds University; discussion of the Twenty-second and Twenty-third Reports of the Joint Research Committee of the Institution and Leeds University—Studies in Carbonisation, Parts IV. and V.; discussion of the Gas Research Fellowship, 1929 Report. At 2.30 p.m., Statement on Use of Creosote in C.W.G. Plants; discussion of the Report of the Refractory Materials Joint Committee, 1929. At 7.15 p.m. for 7.30 p.m., Charter Dinner at the Criterion Restaurant, Piccadilly Circus, London (Jermyn-street entrance). Thursday, at 11 a.m., discussion of the First Report of the Ammonia Sub-Committee. At 2.30 p.m., discussion of the Third Report of the Effluents Sub-Committee.

THURSDAY, NOVEMBER 14th.

Institute of Metals: Birmingham Local Section.—In the Chamber of Commerce, New-street. Open discussion on "Rolling." The discussion forms part of a joint programme arranged by the Birmingham Metallurgical Society, the Staffordshire Iron and Steel Institute, and the Birmingham Local Section of the Institute of Metals. 7 p.m.

Institute of Metals: London Local Section.—At the Royal School of Mines, South Kensington, S.W. 7. "Mineral Flotation," by Mr. H. Livingstone Sulman. 7.30 p.m.

Institution of Welding Engineers.—At Caxton Hall, Westminster, London, S.W. 1. "The Manufacture and Standardisation of Eye-protective Glasses," by Dr. W. M. Hampton. 7.30 p.m.

Society of Chemical Industry: Chemical Engineering Group.—Joint meeting with the Nottingham Section. 2.15 p.m., leave Victoria Station Hotel, Nottingham, for the University, where the Science Buildings will be inspected; 4 p.m., leave the University for Manlove, Alliott and Co., Ltd., where, after a tour of the works, tea will be provided by the directors; 5.45 p.m., leave Manlove, Alliott and Co., Ltd., and return to Victoria Station Hotel; 6.30 p.m., informal dinner in the Coffee Room of the Victoria Station Hotel; 7.30 p.m., joint meeting with the Nottingham Section at the Victoria Station Hotel. "The Scientific Heating of Liquids and Gases," by Mr. J. Arthur Reavell.

FRIDAY, NOVEMBER 15th.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. "Nickel and its Uses in Engineering," by Mr. W. T. Griffiths. 7.30 p.m.

Royal Aeronautical Society.—St. Ermin's Hotel, Caxton-street, Westminster S.W. 1. Informal dinner and discussion. 7.30 p.m.

MONDAY, NOVEMBER 18th, to SATURDAY, NOVEMBER 23rd.

Public Works, Roads and Transport Congress and Exhibition (1929).—Royal Agricultural Hall, London, N. For programme of Congress, see page 423.

THURSDAY, NOVEMBER 21st.

British Waterworks Association.—Agricultural Hall, Islington, London, N. General meeting. Papers:—(*a*) "Water Supply as a Factor in Town and Regional Planning," by G. L. Pepler, F.S.I.; (*b*) "The Purity of Drinking Waters from the Biological Aspect," by Dr. W. Rushton, D.I.C., A.R.C.Sc. (Lond.), F.L.S.; and (*c*) "The Preservation of Rivers and Streams from the Standpoint of Water Supply: Some Observations on River Pollution," by Dr. J. B. Firth, D.Sc. 11 a.m. and 3 p.m.

TUESDAY, NOVEMBER 26th.

Institute of Metals: Birmingham Local Section.—In the Chamber of Commerce, New-street. "The Modern Development of the Steam Locomotive," by Mr. G. W. Woolliscroft. The paper forms part of a joint programme arranged by the Birmingham Metallurgical Society, the Staffordshire Iron and Steel Institute, and the Birmingham Local Section of the Institute of Metals. 7 p.m.

FRIDAY, NOVEMBER 29th.

Institute of Marine Engineers.—At the Hotel Victoria, Northumberland-avenue, W.C. 2. Annual conversazione. Reception, 7 to 7.30 p.m.

SATURDAY, NOVEMBER 30th.

Institute of Metals: Birmingham Local Section.—Queen's Hotel, Birmingham. Fourth annual dinner and ladies' night.

The Institution of Mechanical Engineers.—The following awards have been made by the Council of the Institution of Mechanical Engineers for papers read before the Graduates' Section of the Institution during the session 1928–1929:—Mr. A. B. Winterbottom, M.Sc. Tech. (Student), prize to the value of £5 for his paper on "Heat Insulation;" Mr. W. A. Johnson, B.A. (Graduate), prize to the value of £5 for his paper on "Alloy Steels for Locomotive Construction;" Mr. G. R. Bamber, B.Sc. (Graduate), prize to the value of £2 for his paper on "Automatic Combustion Control of Boiler Furnaces."

Institution of Naval Architects.—The following scholarships have been awarded by the Council of the Institution of Naval Architects:—Fairfield Scholarship in Naval Architecture, 1929, £150 per annum for four years at Glasgow University, to Mr. Samuel McMurray, of Messrs. Harland and Wolff, Belfast; Denny Scholarship in Naval Architecture, 1929, £75 per annum for four years at Glasgow University, to Mr. C. R. Wynne-Roberts, of Bedford School, Bedford; Parsons Scholarship in Marine Engineering, 1929, £150 per annum for three years at the City and Guilds (Engineering) College of the Imperial College of Science and Technology, London, to Mr. F. L. Weatherdon, of H.M. Dockyard, Devonport.